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PROFESSIONAL TRAINING OF THE MEMBERSHIP OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS*

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A YEAR ago, a group of newly elected officers assumed their responsibilities in the Association of American Geographers. This was the first group of officers elected by the Association as one body of members, the officers of the previous year having been elected by the members of two separate, though to a degree overlapping, organizations. With the election of the new group of officers, the Association of American Geographers performed its first major act as a single and established society of professional American geographers. The years of division and the year of amalgamation had come to a close.

What kind of society is this Association? Of whom is it composed? These are questions that should be answered of any professional organization. Because it is new, it is particularly appropriate that they be answered with respect to this association of geographers.

There are many ways in which the membership of a professional society can be analyzed in the search for a fuller understanding of it and the profession its members represent. A profession implies undergraduate preparation for professional training and professional training itself. Thus, some of the more obvious ways in which the membership of a profession should be analyzed are (1) with respect to the fields of study that have comprised the undergraduate preparation and the institutions that have served as the centers of study, and (2) similarly with respect to the two professional degrees—the Master's degree and the Doctorate. It is such an analysis of the membership of the Association that is here presented.

A year ago, the Association of American Geographers had on its rolls a membership of 1370. Data for this analysis were requested from 1334, 36 being overseas in a variety of capacities and difficult to reach. Deaths, resignations, failures to reply, tardiness in replies, and other circumstances reduced to 1150 the number of members for whom data were complete. It is on this number that this analysis is based. The 1150 includes 858 Members and 292 Associate Members. Since it was

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known in advance that the professional differentiation between Members and Associate Members was not clearly defined, a circumstance made clearer by early analysis of data, this study makes no differentiation between these two types of membership. The entire 1150 are considered here and referred to as the same group—members.

The number of members included in this analysis represents 85 per cent of the total membership, July 1, 1950. The addition of 217 members since that date brings the total to approximately 1575. The cases covered thus represent about 73 per cent of the present membership. It can be safely assumed that the data analyzed here are representative of the membership as of July 1, 1950 and to the present. That the data analyzed are also representative of all current professional American geographers may be open to doubt. It seems safe to assume, however, that if the circumstances revealed by the data analyzed here differ from those for all professional American geographers, the differences would not be great or significant.

There are many similarities to be seen in the professional preparation of members of the Association and, it can be assumed, of all professional American geographers and in the professional training marked by the two higher degrees. Many of the same subjects are studied, many of the same institutions serve as centers for preparation and as centers for professional training. The striking differences that occur in these and other respects are largely matters of intensity.

UNDERGRADUATE TRAINING

An outstanding feature of the undergraduate training of members of the Association is variation. Alphabetically, major subjects range from anthropology to zoology. They vary otherwise from Greek to dairying and from art to home economics. Alphabetically, undergraduate institutions range from the Academy of the New Church to Yale University; in location, from Waterville, Maine, to Claremont, California; in size, from some of the smaller—Haverford, for example—to some of the larger—the University of California at Berkeley, for example.

Major Undergraduate Subjects

Among those of the membership who hold undergraduate degrees (1105), the larger single group majored in geography. This group, however, comprises somewhat less than a half (498) of the total. The second larger group, nearly a fifth (214), majored in one or another of the sciences. Almost as many majored in the social sciences, roughly a sixth (175) of the total. A fourth group, about an eighth (144), emphasized pre-professional training. A small group (74) majored in the humanities.

Geography Majors.

Geography as a "major" in the undergraduate programs of the membership is a development of relatively recent years. Only a fourth of the undergraduate degrees in geography were awarded before the early 1930's. Since then the annual increase in numbers has been rapid. By 1940, a half of the undergraduate degrees in geog-

raphy had been awarded. Since 1936, degrees in geography awarded the membership have annually outnumbered degrees in all other fields combined.

Science Majors.

Among the members, undergraduate majors in the sciences include many fields, ranging alphabetically from chemistry to zoology. The earth sciences, almost wholly geology, outrank (122) by a narrow margin all other science fields combined. Emphasis in this direction appeared earlier than it did in geography. About half of the earth science majors received their degrees before 1925. Since then, the number has steadily declined. Majors in the physical sciences, mainly chemistry and physics, constitute a somewhat smaller group (43). About a tenth of the science majors emphasized mathematics (25) and the biological sciences (24). The number of majors in these science fields and mathematics show little variation.

Social Science Majors.

History accounts for the larger number of the social science majors (70), roughly two-fifths of the total. Economics (40) and the general field, *social sciences* (40), account for nearly a fourth each, political science about a tenth (17). Degrees in anthropology, sociology, and other social sciences are few and scattered through the years. Majors in the social sciences appear early among the Bachelor's degrees represented in the Association. But they did not become significant in numbers until the 1920's. Since then, they have declined in numbers but not to the degree characteristic of the earth sciences.

Pre-professional Fields.

Pre-professional fields represented in the undergraduate degrees of the membership include, if they do not range to and from, architecture and the military arts and sciences. Education is dominant, accounting for nearly two-thirds (94) of the total. The other eleven fields are each, represented by a few, only commerce (18) and engineering (10) important enough in numbers to be noted. Education as a field of undergraduate specialization did not become numerically important until the early 1930's. Since then, majors in this field declined in numbers but have remained prominent. Majors in other pre-professional fields have remained relatively constant.

Majors in the Humanities.

Fields in the humanities that served members of the Association as undergraduate majors are dominated by English, that field, in various forms, accounting for roughly a half (36) of this group. Other fields—Greek, German, Latin, the Classics, art, and music among them—are each represented by a few. Most of those who majored in English took their degrees between the 1920's and 1940's. Most of those who majored in the Classics or classical languages earned their degrees before 1900. Degrees in other of the humanities are scattered through the years.

Institutions

Obviously, all but a few members of the Association (47) earned their undergraduate degrees at institutions in the United States. Two hundred and sixty American colleges and universities are represented.

The greater number, slightly more than two-fifths (112), are privately endowed. By a small margin these institutions account for the greater number of undergraduate degrees, nearly two-fifths (405). State supported colleges that now emphasize, or until recent years emphasized, teacher training comprise a somewhat smaller group (83) and are represented by nearly a third of the undergraduate degrees (233). A still smaller group of institutions, nearly a fourth (56), is composed of state colleges and universities. However, these institutions account for almost as many undergraduate degrees as private institutions (384). The number of city, federal, and foreign institutions that granted undergraduate degrees to the membership, and the number of degrees they awarded, are relatively small.

By states, the American undergraduate institutions represented in the Association form an almost complete and unbroken pattern, only the four states of Delaware, South Dakota, Montana, and Wyoming missing. Within this pattern the number of institutions per state varies widely. One major concentration is formed by four eastern and eight midwestern states: Massachusetts (18), New York (21), New Jersey (5), and Pennsylvania (23), and Ohio (18), Indiana (8), Illinois (15), Michigan (11), Wisconsin (9), Missouri (10), Iowa (5), and Minnesota (8). Institutions in these 12 states comprise approximately three-fifths (151) of the American undergraduate institutions represented in the membership.

In number of institutions represented by states, secondary concentrations are formed by Maryland (4), District of Columbia (4), Virginia (4), North Carolina (5), Kentucky (8), and Tennessee (6), and by Nebraska (5), Kansas (6), Oklahoma (4), and Colorado (5). California (9) and Washington (5) are "island" outliers in the pattern.

Elsewhere the representation of institutions by states is light or lacking. This holds for three large areas—the South, the Southwest, and the mountain states—and for scattered states in other sections. States in these areas (25) are each represented, on the average, by slightly less than two institutions.

Private Institutions.

By states, the pattern of private undergraduate institutions represented in the Association forms a relatively unbroken alignment along the eastern seaboard and westward from Virginia to Colorado. Alabama, Louisiana, Texas, California, Oregon, and Utah form scattered "islands".

Slightly more than half (64) of these private institutions each contributed only one undergraduate. Twenty-three each contributed only two undergraduates. Eleven institutions are each represented by four or five undergraduates. The greater numerical contributions originate in only ten institutions. They con-

tributed slightly more than half (206) the undergraduates from private institutions and nearly a fifth of all undergraduate degrees in the Association. In addition, they contributed nearly four-fifths (121) of the undergraduate geography majors from private institutions and nearly a fourth of all geography majors. All of the ten institutions are represented in the membership by ten or more undergraduate degrees. These ten institutions are: Chicago (71), Syracuse (25), Clark (24), George Washington (15), Harvard (13), Columbia (13), Pittsburgh (12), Nebraska Wesleyan (11), Northwestern (11), and Peabody (11). All fall far below Chicago in numbers, and, except for Columbia and Harvard, far behind Chicago in time.

Slightly less than two-fifths (157) of the undergraduates from private institutions majored in geography. Geology (64) and the social sciences (62), mainly history and economics, each account for roughly two-fifths as many majors as geography. Since the early 1930's, geology has declined in relative importance, but the social sciences have maintained their relative positions. The remaining undergraduate majors (122) are scattered through a wide variety of fields and show no definite trends.

State Teachers Colleges.

In their distribution, teacher colleges represented by Bachelor's degrees in the Association follow, for the most part, the same pattern followed by private institutions. The major exception is the greater scattering of teachers colleges away from the eastern seaboard and midwestern states. Two eastern states—Massachusetts and Pennsylvania—and the District of Columbia, and six midwestern states—Indiana, Illinois, Iowa, Michigan, Wisconsin, and Minnesota—account for half (42) of the teachers colleges represented in the Association. But, more important, teachers colleges in these states account for nearly three-fourths of all of the teachers colleges degrees. Particularly outstanding in numbers of degrees are Illinois (39) and Pennsylvania (25). In numbers of degrees awarded, special recognition must be made of four institutions—Illinois Normal University (26), Iowa State Teachers College (14), Wilson Teachers College (11), and the Duluth Division of the University of Minnesota (10). Thirty-four other teachers colleges each contributed one graduate; 21 each contributed only two; the remainder averaged approximately four each, only one—Southern Illinois University—with as many as eight.

Majors in geography are more prevalent among the members who graduated from teachers' colleges than they are among those who graduated from private institutions; but they were awarded their degrees considerably later. Nearly half (100) specialized in geography. Another segment, nearly a fifth (43), specialized in the social sciences, history the more prominent field. Education as a field accounts for slightly more than a fifth (52). The number of majors in any one of the other fields, including geology, are few and scattered. Trends indicated are an increase in the number of geography and education majors and a decrease in all other fields.

State Colleges and Universities.

Although state colleges and universities number only half (56) the number of private institutions represented by undergraduate degrees in the Association, they account for nearly as many degrees (385). In distribution, by states, these state institutions present the most complete pattern of the three larger groups. Only four eastern states—Vermont, Connecticut, Rhode Island, and Delaware—and four western states—South Dakota, Wyoming, Montana, and New Mexico—are missing.

In numbers of degrees awarded to members by these state institutions, two areas are particularly outstanding. Ten midwestern and adjoining states account for roughly two-thirds (243) of the total: Pennsylvania (16), Ohio (38), Indiana (13), Illinois (26), Michigan (58), Wisconsin (35), Missouri (9), Iowa (8), Minnesota (16), and Nebraska (24). Three western states—California (44), Oregon (9), and Washington (22),—are represented by nearly a fifth (75) of the total. Remaining significant numbers were contributed by Oklahoma (13) and Colorado (11). These 15 states awarded nearly nine-tenths (342) of the undergraduate degrees awarded the membership by state colleges and universities. Most of the remaining states are represented by one or two graduates, only one institution—the University of Tennessee—represented by as many as four.

The impact of five state universities is unmistakable: Michigan (47), Wisconsin (35), University of California—Los Angeles (27), Illinois (25), and Nebraska (24). Together they contributed two-fifths (158) of the total number of undergraduate degrees awarded by state colleges and universities; half (107) of the degrees awarded in geography; and slightly more than a fifth of the degrees in geography awarded by all types of institutions.

Geography majors account for slightly more than half (206) of the undergraduate degrees from these state institutions. They appeared early and have continued to increase in numbers since 1900. The earth sciences, second in number (56), almost wholly geology, also appeared early but have declined in relative importance since the middle 1930's. The social science majors, primarily history and economics, are almost as numerous (52). They appeared later and declined in number but not to the same degree as the earth sciences. Pre-professional fields, largely education and commerce, are important (47). Their relative positions and those of other majors have remained relatively constant.

City Colleges and Universities and Federal Institutions.

Seven city colleges and universities and two federal institutions are represented by undergraduate degrees in the Association. The first group—Brooklyn College (3), Cincinnati (5), Hunter (7), City College of New York (7), Toledo (1), Wayne (9), and Wichita (1)—contributed a total of 33 degrees, all in relatively recent years. Geography majors accounted for a third (11) and geology majors a fourth (8). Other majors are scattered through seven fields. The United States Military Academy and the United States Naval Academy contributed three graduates, all degrees emphasizing military arts and science.

Foreign Institutions.

Forty-seven members of the Association hold degrees from institutions outside of the United States. Most of these degrees (32) were earned in English speaking countries: Canada, accounting for the greater number (21), England (8), and Australia (3). Continental Europe (8), Asia (6), and Brazil (1), contributed the remainder. Geography is relatively strong as a major subject among these degrees, representing nearly half (22) of the total. Geology (6) and history (8) account for the greater portion of the remainder.

Summary

In terms of the undergraduate degrees held by the members of the Association, the larger contributions in the undergraduate training of American geographers have come from the East, Midwest, and Pacific Coast. Ten institutions are particularly outstanding; two in the East—Clark and Syracuse; six in the Midwest—Michigan, Chicago, Illinois Normal, Illinois, Wisconsin, and Nebraska; and two on the Pacific Coast—University of California at Los Angeles and Washington.

In terms of the undergraduate majors of members of the Association, geography did not become well established until the 1930's. But once established, it increased rapidly in prominence, to date accounting for the undergraduate majors of nearly half the geographers and currently accounting for nearly all of them.

In numbers of undergraduate majors, geology, history, economics, and education are strongly represented among geographers, but the number of majors in these fields has declined in recent years. Currently they account for only a few.

THE MASTER'S DEGREE

Much of the variation that characterizes the undergraduate training of members of the Association is absent in their training for the Master's degree. The range of subjects in which Master's degrees were earned is narrower. The fields that comprise the range are fewer. Geography accounts for a larger portion of the degrees earned. And the number of institutions represented are far fewer and not so widely dispersed.

Subjects Represented

Professional decisions in the making on the undergraduate level become fact on the Master's level. Among the members who hold the Master's degree (850) nearly four-fifths (667) chose geography as their major subject. The second larger group, representing somewhat less than a tenth of the total (73), majored in one or another of the sciences. About half as many (35) chose to emphasize one of the social sciences. A third group, small in number (47) earned their degrees in a professional field. A very few (4) chose the humanities.

Degrees in Geography.

Specialization in geography on the Master's level roughly parallels, in time, specialization on the undergraduate level. Only a fourth of the Master's degrees

in geography were earned by members of the Association before the 1930's. After that date the number increased steadily and rapidly, the greater increases occurring since World War II with a fourth of all the Master's degrees in geography earned since 1947. In contrast to undergraduate degrees, geography on the Master's level has been consistently strong. Since 1900 degrees in geography on this level have regularly numbered more than degrees in all other fields combined and since the 1940's, degrees in other fields have been negligible.

Degrees in the Sciences.

Only a few science fields are represented among the Master's degrees held by the membership. Geology is the more dominant, accounting for about two-thirds (52) of the group. A few (10) are held in the biological sciences. The remainder (11) are scattered through meteorology, mathematics, and other earth and physical sciences. To the 1920's, degrees in these sciences roughly paralleled those granted in geography in time and rate of increase. The peak was reached in the early 1930's. Since then the decline has been steady and rapid.

Degrees in the Social Sciences.

The number of social science fields represented by Master's degrees in the Association is considerably smaller than the number of science fields. As a group they are dominated by history (16) and economics (9), these two accounting for three-fourth of the total. The several (10) remaining are accounted for in anthropology (1), political science (4), psychology (2), and *social studies* (3). Although degrees in the social sciences are too few to reveal any conclusive trends, it should be noted that they did not appear, for the most part, until the 1920's, but have retained their relative position since then.

Degrees in Professional Fields.

Three-fourth (35) of the Master's degrees held in professional fields by members of the Association are in education. These degrees did not begin to appear until the early 1920's. For a time the number remained relatively constant, but since 1940 it has declined to a negligible figure. The remaining professional degrees (12) are scattered through six fields: commerce, forestry, landscape architecture, library science and city planning—too few to reveal any conclusive trends.

Institutions

Nearly all (826) members of the Association who hold the Master's degree earned their degrees at institutions in the United States. About a third as many institutions (77) are represented as are represented by undergraduate degrees, the greater number (67) appearing in both lists of institutions. About two-fifths (28) of the institutions that awarded these degrees are privately endowed colleges and universities. But they account for slightly more than half (443) of the degrees held. State colleges and universities comprise the larger number, approximately half (38) of the total. But they account for only about two-fifths (364) of the degrees granted. The number of teachers colleges in the group is small (7) and

the number of Master's degrees they awarded is negligible (9). City institutions are not significant in number (4) nor in degrees granted (10). The number of foreign institutions represented by Master's degrees is relatively large (20), but the relative number of degrees granted is small (24).

Thirteen states are not represented by institutions at which Master's degrees were earned by the membership. But these 13 states are so scattered as to give the pattern, by states, the appearance of being relatively complete. In number of institutions per state, the distribution is quite irregular, and in number of degrees granted, even more irregular.

In number of institutions per state, the area of higher concentration appears from Massachusetts westward to Colorado, reminiscent of the distribution of undergraduate institutions represented in the Association. The 12 states in this alignment account for about three-fifths (46) of the institutions at which Master's degrees were earned. More significant is the fact that the institutions comprising this group awarded approximately three-fourths (629) of the Master's degrees held. With the addition of Wisconsin (58) and Nebraska (51), each with only one institution represented, the number of degrees awarded by institutions in these 14 eastern and midwestern states is raised to nearly nine-tenths (738) of the Master's degrees held.

Four states—California, Utah, Tennessee, and Maryland—and the District of Columbia are each represented by two or by three institutions; the remaining 17 states and Hawaii each by only one. In numbers of degrees granted only four "islands" of concentration appear outside of the 14 states noted—California (23), Washington (24), Tennessee (33), and the District (13).

Private Institutions.

The 28 private institutions represented in the Association by Master's degrees are restricted in pattern by states, more restricted in numbers of institutions per state, and even more restricted by number of degrees granted. All but four of the states and four of the institutions represented are east of the Mississippi. Of these all but one state and two institutions are north of the Ohio River line.

Within this northeast section, three states are quite outstanding in the number of Master's degrees their institutions awarded members of the Association—Massachusetts (134), New York (112), and Illinois (122). They contributed somewhat more than four-fifths (368) of the degrees granted by private institutions and somewhat more than two-fifths of all the Master's degrees held. These figures draw particular attention to two institutions—Clark (103) and Chicago (98)—without whose contributions a significant segment of professional training on the Master's level would be lacking. Together they contributed nearly a half of the Master's degrees awarded by private institutions to the membership and about a fourth of all Master's degrees held. These two universities and seven others—Syracuse (50), Columbia (38), Northwestern (24), Harvard (22), Peabody (25), Pittsburgh (15), and George Washington (11)—again reminiscent of undergraduate training,

contributed nearly nine-tenths (386) of the Master's degrees awarded by private institutions and nearly a half of the Master's degrees earned at American institutions.

Two distinctions should be made among these nine institutions. Compared to others, Syracuse, Northwestern, and Pittsburgh are late comers. And more so than others in the group, the Master's degrees granted by Harvard and Columbia show a proportionately less emphasis on geography than on other fields.

State Colleges and Universities.

The 38 state colleges and universities that have granted Master's degrees to members of the Association give the pattern of the group its relatively complete appearance. Thirty states are represented, the only large block of states not represented occurring north of New Jersey and New York. Since these state institutions are distributed, for the most part, one to a state, no concentration in these terms appear. By number of degrees granted to the membership, the circumstances are quite different.

Here again, midwestern states stand out, a group of five accounting for nearly a half (172) of the Master's degrees earned at these state institutions—Ohio (31), Michigan (46), Indiana (12), Illinois (25), and Wisconsin (57). The addition of Pennsylvania (16), bordering on the east, and three states bordering on the west—Minnesota (7), Iowa (7), and Missouri (6)—raise the figure materially. Five Plains states—North (2) and South (3) Dakota, Nebraska (51), Kansas (4), and Oklahoma (9)—with Colorado (13) form a secondary block of states in terms of Master's degrees held. California (23) and Washington (24) each constitutes an "island" of concentration. With perhaps the exception of Tennessee (7), the Master's degrees granted to members by institutions representing the remaining 13 states and Hawaii are few (26), averaging about two each.

Institutionally, there can be no questions raised as to where the greater contributions of state institutions to the Master's level of professional training originated. Three universities are outstanding in the number of degrees awarded—Wisconsin (58), Michigan (44), and Nebraska (51). Together they contributed about two-fifths of the Master's degrees earned at this group of institutions. Also notable, but in a different class are Illinois (25), Ohio State (23), and Washington (24). Four additional universities complete the more important—California at Los Angeles (18), Colorado (13), Indiana (12), and Pennsylvania State (11).

Few differences are distinguishable in the Master's degrees awarded members of the Association by state institutions and by private institutions. They began to appear in the two groups of institutions at about the same time and increased in number at about the same rate. Degrees earned at state institutions show a narrower range of subject. Emphases on geography are in approximate balance, but state universities show a slightly greater relative emphasis on professional fields and the social sciences and a slightly less relative emphasis on geology. Among the state universities more prominent in number of degrees granted, California at Los Angeles, Colorado, Pennsylvania State, and Washington are relatively late comers. No other significant distinctions are apparent.

Teachers Colleges and City Institutions.

The few teachers colleges (7) and city institutions (4) that have granted Master's degrees (19) to members of the Association warrant noting on only two points. They are quite recent in their entry on this level of professional training and in this training reveal a very dominant emphasis on geography.

Foreign Institutions.

The 20 institutions located outside of the United States that are represented among the Master's degrees (24) held by the membership are located primarily in the English speaking countries of Canada, Great Britain, and Australia. These three countries account for half (10) of the institutions represented. Canada (6) and England (6) account for half the Master's degrees granted. Continental Europe is represented by seven institutions and as many degrees. Most of the degrees (19) were granted in geography. Two were granted in geology and one each in biology, economics, and Chinese literature.

Summary

In numbers of first year graduate students, Master's degrees held by members of the Association reveal the East and the Midwest as making the larger contributions to the professional training of American geographers. Thirteen institutions are particularly prominent on the Master's level; the same two eastern universities previously noted—Clark and Syracuse—and two additional eastern universities—Columbia and Harvard; and five of the same midwestern universities noted—Michigan, Chicago, Illinois, Wisconsin, and Nebraska—and two additional institutions—Ohio State and Northwestern.

As a graduate field on the Master's level, geography was not well established until the 1930's. Since then it has grown in prominence, the greater growth coming since the later 1940's. Master's degrees in other fields than geography, mainly geology and education, have played a relatively unimportant part in the professional training of geographers. In recent years, the Master's degrees earned have been almost exclusively in geography.

THE DOCTORATE

Trends indicated from the Bachelor's and the Master's degrees held by members of the Association are emphasized between the Master's degrees and the doctorates. The range of subjects on the doctorate level is, as would be expected, much narrower and the subjects comprising the range are fewer. The number of institutions granting the doctorate are fewer and not so widely dispersed. By degrees granted, the primary contributions originate in only a very few institutions.

Subjects Represented

Emphasis on geography among the doctorates held by the membership is dominant but no more so than it is on the Master's level. Of those holding the doctorate, approximately four-fifths (330) took their degrees in geography. Degrees in other fields (77) are dominated by the physical and biological sciences,

these two categories accounting for about three-fourths of the degrees not earned in geography. By far the greater portion (37) of these degrees are in geology. Other physical and earth sciences (9) and the biological sciences (11) account equally for the remainder. The social sciences—anthropology (2), political science (2), economics (5), history (6), and sociology (1)—constitute a group second in numerical rank, economics and history somewhat more prominent. A negligible number in education (3) and medicine (2) complete the list.

Doctorates in geography were earned by members of the Association relatively early in the 1900's. But they were few and scattered until the early 1920's. Before 1920 only 10 out of 33 doctorates were awarded in geography, whereas 13 were awarded in geology. Eight were awarded in the biological sciences, nearly all of those currently held. From 1920 to 1930 the number of doctorates in geography increased, whereas the number in geology remained relatively constant. After 1930 doctorates in geography increased more rapidly in number whereas those in geology declined. Most of the doctorates in all of the other fields represented were awarded between 1920 and 1940. Since 1940 geography has accounted for doctorates awarded the membership to the relative exclusion of all other fields.

Institutions

Doctorates were awarded to 379 members by 35 universities in the United States and to 28 members by 20 universities outside of the United States. The 35 American universities are about equally divided between privately endowed (18) and state supported (17) institutions. In contrast to undergraduate and Master's degrees, institutions outside of the United States that granted doctorates to members of the Association are dominantly those representing Continental Europe (19), rather than English speaking countries (9).

By states, the American universities represented in the Association by doctorates form a simple pattern. One alignment extends southward from Massachusetts to the District of Columbia. A second unbroken alignment lies westward from Massachusetts to Nebraska and Kansas. North Carolina, Tennessee, California, and Washington constitute "island" outliers. Except in the case of New York, the number of institutions in each state is, for the most part, one or two. New York is represented by five; Pennsylvania and California each by three. The emphases evident here duplicate emphases noted in the distribution of institutions represented in the two lower degrees. The consistency of the pattern of institutions by states, is broken in terms of the number of degrees granted. Again this distribution re-emphasizes the patterns of other degrees.

Three-fourth (267) of the doctorates held by the membership were awarded by institutions in five states, two in the east—Massachusetts (87) and New York (32)—and three in the Midwest—Illinois (84), Wisconsin (28), and Michigan (36). California (24), and Nebraska (17), contributed significant numbers, these seven states accounting for four-fifths of the total. By separate institutions the concentrations are even more pronounced.

Private Universities.

Private universities contributed three-fifths (228) of the doctorates held by the membership. Eleven universities awarded 21 doctorates, none more than three—Catholic University (2), Duke (1), Fordham (1), George Washington (2), Johns Hopkins (3), New York (1), Pittsburgh (3), Stanford (1), Syracuse (1), Washington University (3), and Yale (3). Two institutions contributed small but significant numbers, Cornell (7) and Peabody (7). Three institutions contributed somewhat larger numbers—Columbia (22), Harvard (11), and Northwestern (10). But these 16 out of a total of 18 private universities awarded only a third of those awarded by the entire group. Two, alone—Chicago (74) and Clark (76)—accounted equally for the remaining two-thirds, their total amounting to two-fifths of all of the American doctorates.

Most of the American doctorates (22) awarded members before 1920 were awarded by private universities—Chicago (9), Columbia (4), Cornell (4), Harvard (1), Johns Hopkins (2), Pittsburgh (1), and Yale (1). With the exception of those awarded by Chicago, among which geography was strongly represented, nearly all of the early degrees were in geology or the biological sciences. These trends have continued at these universities, accounting for the larger proportion of degrees (48) representing other fields than geography as compared to those earned at state universities. Doctorates awarded by Clark appeared in the early 1920's; those awarded by Peabody are confined to the 1930's. Degrees from these two institutions are almost exclusively in geography. The same holds true, for the most part, for the remaining private universities whose doctorates were awarded in recent years.

State Universities.

Seven state universities awarded 11 doctorates held by the membership, none awarding more than three—California at Los Angeles (3), Kansas (1), Michigan State (1), Missouri (1), Pennsylvania (3), Pennsylvania State (1), and Rhode Island College of Education (1). Three universities contributed small but significant numbers—Indiana (5), Iowa (4), and Maryland (4). Somewhat larger numbers were contributed by three universities—North Carolina (8), Ohio State (9), and Washington (10). The greater proportion of the doctorates in this category were awarded by four institutions—California at Berkeley (20), Michigan (35), Nebraska (17), and Wisconsin (28). Together they account for two-thirds (100) of the degrees awarded the membership from state universities, slightly more than a fourth of all of the American doctorates.

Only five state universities awarded doctorates to members of the Association before 1920—California at Berkeley (1), Michigan (2), Nebraska (1), Pennsylvania (2), and Wisconsin (1). Of the seven degrees they awarded before that year, only two were in geography, the biological sciences accounting for the greater number. This emphasis on other fields than geography continued until 1930 except at Wisconsin where all of the degrees granted members of the

Association have been in geography. After 1930, the relative position of the fields other than geography declined sharply. Since 1940, the number has been almost negligible. This not only reflects the trends established in institutions represented in earlier years, but also the trends among the doctorates awarded by institutions only in recent years.

Foreign Institutions.

Only a few members of the Association hold doctorates earned at institutions outside of the United States—a total of 28 out of 407 doctorates. In relation to the number of doctorates so earned, the number of institutions—20—is much greater than holds for American degrees. Five universities in English speaking countries account for nine doctorates: in Canada—Toronto (3), Montreal (1), and McGill (1); in England—London (2); and in Australia—Sydney (2). The remaining 15 institutions and 19 doctorates represent Continental Europe: in Germany—Bonn (2), Munich (2) and Berlin (1); in Switzerland—Zurich (1), Grenoble (1), and Freiburg (1); and in each of nine countries—Paris (2), Utrecht (1), Warsaw (1), Vienna (2), Prague (1), Budapest (1), General Staff College, Belgrade (1), St. Petersburg (1), and Stockholm (1).

As a group, doctorates earned by members of these universities show the same trends noted with respect to doctorates earned at universities in this country. The earlier degrees were not earned in geography-geology and related fields dominating. After 1920, the number of doctorates in geography increased and a few degrees in the social sciences appeared. In later years, geography was virtually the only field represented.

POSTSCRIPT FOR THE FUTURE

Here, then, within the limits of this analysis, is the professional training of members of the Association and, to the extent that the Association represents all American geographers, the American geographic profession. The achievements of American geographers in science, education, and public service have been many and bright. We have every right to predict the continuation of such achievements. Whatever they may be, lies almost wholly, if not wholly, in the hands of the Association's membership. For what may we express a hope? For many things, of which the following are but a few.

The Region in Geography

The region as a concept is vital to geography. It is a simple concept. We should keep it so. When applied in geography, the region as a concept becomes essentially a device—a contrivance—a scheme. So vital is it that it attracts our attention. As a result we become, from time to time, concerned with the details of its mechanisms. So concerned, we are in danger of creating of it a monstrous thing, too complex and formidable to be used for the purpose it was designed to serve. Thus we lose its utility.

The region in geography has but one purpose. Geography deals with phe-

nomena that have the quality of distribution. Findings in geography with respect to these phenomena must be presented so that their true distributional quality is revealed. Understandings derived from these findings must be similarly demonstrated. In its application, the region as a concept becomes the device by which these requirements are met. In this sense, the region as a concept is a guiding principle in geographic research, but in its ultimate application it is not a tool of research. It becomes a device of presentation and demonstration.

As a device for presenting and demonstrating geographic findings and understandings, the region as employed in each specific case is formulated rather than discovered. It is a product of the phenomena with which it deals, the findings and understandings peculiar to the individual circumstances in which it is employed, and the specific process of judgment, analysis, and interpretation deemed by the geographer as appropriate to the purpose served.

In view of these circumstances three facts become apparent. First, the geographic region, though it deals with actuality, does not reveal actuality except within the limitations of the criteria laid down by the geographer in each instance of its use; second, the concept of the region is constant, but the product of each application of the concept is new—unique—different; and third, any attempt to classify, type, categorize, or otherwise generalize geographic regions requires disregarding the precise qualities that they were originally formulated to reveal and which give them their significance, plus the processes of judgment, selection, analysis, and interpretation exercised by the researcher himself. Thus regions are not discovered. They are formulated. They concern actuality. But they are not actuality.

Physical Geography

Geographers, it appears, have forsaken a field that is historically a part of geography, that is uniquely geographic in nature, that is vital to the wholeness of geography, and that is essential to understandings sought by other disciplines than geography that deal with human phenomena. This field is physical geography.

As of now we speak of physical geography, to what do we refer? We refer to physiography, climatology, hydrography, oceanography, soils geography, plant geography, zoo-geography, and the like. One of these is no more physical geography than the arm of a man is a man. Each is a part of the whole, but none is itself the whole. The consideration of each, assembled though the consideration of them all may be within the covers of the same volume, produce physical geography no more than does the assembling of all the materials for a house produce a finished structure.

Geographic understandings of vital significance have been and should continue to be derived from the study of the separate elements that in their composite comprise man's habitat. Vital though these understandings may be, they fall short of the ultimate in geography. More frequently than not, they remain ends in themselves rather than means of achieving an understanding of the whole.

The concern of geography is actuality—actuality with respect to area. Under-

standings that do not go beyond single sets of natural phenomena do not deal with the actuality of area because no single set of natural phenomena exists unassociated in an area separate from the others. Disassociation is not in accord with fact. A new approach is needed in physical geography. This approach should make the understanding of the whole, and not just the understanding of the parts, its objective.

Area Development

Programs concerned with the development of an area—its resources, its facilities, its livelihood potential—provide opportunities for significant contributions from geography. There are several points of view current in the geographic profession toward such programs. Lacking a full understanding of the processes of area development, one point of view assumes these programs to be mainly if not wholly the concern of geography. Another point of view, reflecting the empire building attitude, urges that geography should take over programs of area development and depreciates the contributions of other disciplines. A third point of view, lacking a full understanding of such programs and lacking a full appreciation of the potentialities of their own discipline relegate geography to such minor roles as compiling land use maps. Before concerning themselves with problems of area development, geographers would do well to familiarize themselves with the processes and problems involved.

The processes of area development are by no means simple. This is true regardless of the nature of the area, the type of development, or the agency concerned—public or private. Some clarity may be derived, however, from a skeleton statement of major elements.

The processes of area development can be broken down into five steps. Each is intimately allied to the others, particularly those that precede or follow it. But each is sufficiently distinct to be recognized.

Step One: Program Objective.—The values to be sought through area development must first be established and fully understood. They may be wholly social, or wholly economic, or a combination of both. Whatever they are determined to be, they constitute a continuing controlling factor until they are achieved.

Step Two: Area Analysis.—The second step consists of the inventory and analysis of the resources of the area and their present uses; an appraisal of the efficacy of these uses with regard to the resources themselves and with regard to the economic and social values currently derived from these uses; and an analysis of the resources not used or not used effectively and an appraisal of their use potentials in terms of the objectives sought.

Step Three: Program Development.—This step projects in broader outline the various programs that would lead to a more effective use of resources currently used and the effective use of resources not currently used or not fully used; an appraisal of values that would accrue in terms of each pro-

gram; and decisions as to the most effective and feasible program or programs in terms of the objectives sought.

Step Four: Program Planning.—In the fourth step all of the plans essential to the program or programs selected are developed in detail; and the plans are broken down into the separate elements or segments for assignment to agencies of effectuation according to their established functions and responsibilities.

Step Five: Program Effectuation.—The last step consists of analyzing each plan and the elements of each with respect to timing; developing the procedures necessary to procure action on the part of agencies and bodies involved; and putting plans into action according to the adopted time schedule.

The fact that area development is not primarily a geographic problem should be evident. The fact that geography has more than a minor role to play should be equally evident. It should also be evident that any geographic research proposed under the guise of a contribution to area development has no practical value and remains a purely academic undertaking unless and until it is truly a part of a process, the other elements of which have been developed, agreed to, and are concurrently in operation.

The Functions of Geography

Geography has been defined as the science of area and in many other ways that emphasize geography's concern with phenomena that have the quality of areal distribution and differentiation. In order to function effectively, geography so defined must uncover every possible significant feature of an area, it must devise the most effective possible techniques of portraying these areal features, and, for fear some important aspect of the area is not observed, geography must develop the most effective possible skills of description. These skills of areal analysis, depiction, and description are so important in geography, their development and repeated use have virtually consumed the whole of the geographer's attention. What has been the result?

To a large degree the results has been that geographers have come to be looked upon as the expert providers of information about areas. To a large degree this is the function geographers have performed. It appears that this concept of the function of geography is not an unusual one among geographers themselves. Evidence is to be found in the primary attention given to factual analyses, depictions, and descriptions that characterize most doctoral dissertations, professional papers, and textbooks in geography.

Providing full and accurate factual information about an area, including pointing out its significant differences from other areas, depicting this factual information accurately and effectively, and properly describing the area—these are extremely important functions in the promotion of areal knowledge and learning. If these are the functions of geography, we should recognize them as such, divest ourselves of efforts to the contrary, and devote our entire attention to them without apology.

These functions make geography primarily a technical field and of geographers, primarily technicians. As such, neither geography nor geographers would stand alone. There are other long established and honored technical fields manned by technicians.

Area analysis, depiction, and description, though extremely important, we do not recognize as end products in area knowledge and learning. Some geographers recognize this and express themselves at length and effectively, concerning the geography of area rather than concerning the facts that comprise the geography of area. On occasion, geographers employ the results of analysis, depiction, and description as bases for the development of ideas, predictions and postulations and even, sometimes, as bases for suggesting principles or even, policies that imply action. But, more frequently than not, it would seem, thoroughness beyond description declines and, as a rule, that it has declined is pointed out, the contrary being noted as inappropriate to the purposes to be served as stated.

What the functions of geography are in the field of learning is not wholly within the powers of geographers to say. But it is almost wholly so. Is our place to be at the council tables of sciences, education, and public affairs where ideas are generated and exchanged, where policies are determined, and decisions are made? Or is our position only behind those who sit at these council tables providing them with the expert information that is essential to ideas, policies, and decisions? We should decide first where our place shall be. If it is only behind and in support of those who sit at these council tables, we should divest ourselves of all appearances to the contrary. If our place is to include sitting at the council tables, we should relax our efforts not a whit with regard to the techniques of geography, but add to those efforts the intellectualizing and philosophizing that being masters of information puts us in so strategic a position to accomplish. When we have done so, we will need neither to demand nor to argue for a place at the council table. We will be asked to take our place there.

To Implement Functions

Periodically the concept of geography is subjected to re-statement. Each re-statement provokes discussion. These re-statements and discussions serve a useful purpose and should not be discouraged. Each ultimately demonstrates, as did its predecessors, that regardless of any verbal twist the concept of geography is given, the fundamental character of geography continues unchanged.

Geography is concerned with the totality of area. To be studied, the totality of area must be broken down into its component, each becoming the center of attention. Thus in its approach geography is systematic. Studies that confine themselves to this approach we label *systematic*. When the findings and understandings with respect to these components are integrated geographically—that is, areally—they form the base from which areal findings and understandings are derived and formulated. Studies that perform this function we label *regional*.

In their composite all of the components of area, physical and cultural, to-

gether comprise for a specific area its geographic circumstance. Since the geographic circumstance of an area is a composite, it possesses geographic distinction and unity only insofar as each of its components remains areally constant. At the point where a change in one or more components occurs, a different geographic circumstance occurs. Similarly, since the geographic circumstance of an area is a composite, any change that occurs in one or more of its components in point of time, produces a new and different geographic circumstance. Thus, as the science of area, geography is both fluid as to place and dynamic as to time.

Some aspects of the geographic circumstance are quite apparent. Their significance can be readily recognized. Other aspects of the geographic circumstance are less apparent, their significance is more difficult to discern. The more thorough geographic studies are, whether systematic or regional—that is, the farther geographic studies go beyond the obvious, the more effectively will the functions of geography be implemented.

The past in geographic research has laid the foundations for an increased and a more widespread thoroughness. With some notable exceptions, systematic studies have attempted to encompass topics so comprehensive in scope or have been pursued so incidentally as to make impossible the thoroughness appropriate to their significance. With similar notable exceptions, regional studies have attempted to encompass areal units so large in scope or have been pursued so incidentally as to make impossible the thoroughness appropriate to their significance. In either case have we truly implemented the functions of geography. Individually, we have specialized. But individually we have elected to specialize in “too much” or “too many” to be properly recognized as specialists.

We have yet to find the full depth of the significance of geographic circumstance both in terms of place and in terms of time. When we have more fully done so, we will have more fully implemented the functions of geography as the science of area.

THE DECLINE OF NORTH AFRICA SINCE THE ROMAN OCCUPATION: CLIMATIC OR HUMAN?*

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INTRODUCTION

THE study of climatic change is a fascinating and elusive exercise. Especially as the record of earth history begins to merge with the beginnings of human civilization, profoundly significant questions hinge on the dynamic relationship between a changing physical environment and the adaptive qualities of early man and his heirs. It has been suggested from more than one field of enquiry that climatic change was an important factor in the first dispersion of the human progenitor from the deforested plains of central Asia, and that the vagaries of climate have ever since exercised a controlling influence on the nature and location of the civilizations which man at different periods has established. These suggestions are eminently plausible, and they lend considerable insight to the understanding of prehistory, but the evidence on which they are based is annoyingly imprecise. The climatic record has been sketched on a broad canvas. No one has yet discovered a measure accurate enough to prove conclusively what the climate was, in all its important details, for any single region at any given time during the Pleistocene, nor to chart the changes in climate for any region with enough precision to match the comparatively kaleidoscopic changes in human settlement.

The imprecisions and hiatuses in the evidence are grossly magnified when one attempts to reconstruct the interrelationship between climate and man for the period of less than 2,000 years since the end of the Roman occupation of North Africa. Here and there during this period we find a few shaky points of reference on the basis of which we may attempt to project the broad curve of climatic change from the evidence of the prehistoric period, but we are not on firm ground. It is necessary to a discouraging extent to rely on a *post hoc ergo propter hoc* line of reasoning, using changes in human settlement as a clue to climatic changes which may have influenced them, attempting to find extra-climatic causes, weighing the whole together, and as the end result producing a far from satisfactory answer to the question of whether climate or man has been fickle.

*The subject of this discussion is an old one, worked over by a variety of students from different academic disciplines during the last fifty years and more. The present writer claims no professional standing as an archeologist, geologist, or climatologist. He does however claim an editor's privilege in attempting to introduce a degree of order and evaluation into the mass of scattered data and divergent opinion. This discussion is an attempt by a geographer to focus the major evidence and arguments of scholars whose previously unrelated work bears on the question posed here. Toward this end, a selected (but by no means complete) list of works relevant to the problem discussed is included at the end of the paper.

For these reasons, the present discussion does not attempt to give a definitive answer to the problem posed in the title, but confines itself to a review of the main line of evidence, suggesting the relative importance of each, and aiming at a balanced estimate of probabilities only.

THE NATURE OF THE EVIDENCE

In the dust that has been raised over the issue of climatic change in historic times, notably by Ellsworth Huntington, one cardinal point has not been clearly defined, namely, the difference between progressive change on the one hand, and, on the other hand, fluctuations returning periodically to a relatively constant mean. Either concept is ambiguous unless it is reduced to specific time intervals. For the world as a whole, Brooks suggests,¹ as a summary or average of many individual opinions, that climate has been relatively uniform since at least 300 B.C. This is to say that fluctuations from the mean during that period have not in general been great or long-lasting enough to constitute a distinct climatic epoch, and that climate has periodically returned to the mean (or as near to it as actual cases ever approach this mathematical concept) during a large part of that time. This apparently straightforward picture, is however, greatly complicated by the smallness of the margin of existence in semi-arid areas. Inhabitants of dry places, such as North Africa, the North China Plain, or the Dakota wheat lands, are acutely conscious of the hard fact that rainfall is often most variable where its average annual amount is least and where only a slight decrease can be ruinous to agriculture or even to herding. It is perfectly possible to argue that in the case of North Africa the margin was shaved too close at several periods, and that human settlement deteriorated or vanished as a result. However it is in these same marginal areas that climatic evidence is scantiest, and this applies especially to rainfall. The rate of tree growth or changes in lake levels cannot be observed in the absence of trees or lakes. Contemporary local accounts are suspect, because a man born into a dry climate may give an exaggerated evaluation of a series of wet years, or vice versa, especially when no adequate quantitative measure is used. The extent and nature of cultivation may be significantly influenced by irrigation or by available groundwater inherited from an earlier age, as well as by contemporary rainfall. And the human variable is of key importance in making more or less effective use of areas where the climate puts a premium on ingenuity, organization, and technical skill.

For example, generalized accounts of the first century A.D. from the Mediterranean area show a natural vegetation, cultivated crops, methods and dates of sowing and harvesting, and local fauna which suggest that the climate then was about the same as it is today.² The famous weather journals of Ptolemy, which show a North African climate considerably moister than the present, have been largely rejected as evidence by students of the problem because it seems likely that they were actually written in Greece on the basis of indirect reports, and not in Alexandria,

¹ Brooks, 1949, p. 321.

² Berg, 1914.

and because they contain no quantitative measure or indication of consistent conditions of observation.³ Gsell has demonstrated⁴ that the camel was introduced into North Africa by the Romans, although not on the scale accompanying the later Arab invasion. He shows that camels were in use as far west as Algeria by the fourth century A.D., and that they may have been brought in by the Romans directly by sea from their provinces in Syria, where the usefulness of the camel in a desert environment had long been clear. Roman importation of the camel would seem to indicate that their African empire was as much of a desert then as it is now. The presence of the camel did not radically change Roman (or Byzantine) land use in North Africa, which continued to be based on irrigated agriculture in the oases. It remained for the Arabs, a desert people, to make the camel a principal agent of the change from sedentary to nomadic occupancy of North Africa.

In a climate where very slight changes are of crucial importance, none of the above evidence can be considered satisfactory toward an answer to the problem. It tells us no more than we know from a casual reading of history, namely, that the climate of North Africa was about the same in Roman times as it is now, although it may have differed locally in greater or less degree, but that land use in North Africa since that time has changed radically under conditions which might lead one to suspect that climatic change has had something to do with it.

THE PREHISTORIC PERIOD

Wind erosion has obliterated many of the traces of earlier wet periods, but there is ample evidence of several periods during the Quaternary of moisture greater than the present, contained in the presence of fossil and relict fauna and flora, stone implements, culture sites, fossil drainage, and terraces. The distribution of fossil and relict fauna indicates an earlier water link between the Sudan and the Mediterranean through the central Sahara, and presupposes therefore a period or periods of rainfall greater than the present. Dwarfed relict specimens of fish and crocodiles are now found in the Ahaggar and Tassili massifs of the central Sahara (the wettest parts of North Africa at present, aside from the Mediterranean littoral and the Atlantic-facing slopes of the Atlas mountains, and thus perhaps the last stand of species whose fossils are found more widely distributed over North Africa), and their occurrence was also noted by Herodotus, who described the crocodiles as three cubits long, compared to seven cubits for the Nile species.⁵ Neolithic sites are scattered over many areas in the Sahara now totally uninhabited. Where historic settlement remains are limited to the tops of ridges in search of rain, the

³ Hellman, 1916. Herodotus and Diodorus both describe the climate of Egypt in their day in terms which fit the present, but their more favorable accounts of "Libya," as most of the remainder of North Africa was then called, are based on fanciful second- and third-hand reports which are wholly out of accord with the probabilities.

⁴ Gsell, 1933.

⁵ Rawlinson, 1928, p. 132; Pélégryn, 1911. This would seem to indicate that dry conditions had already been dominant for some centuries before 300 B.C.

Neolithic sites are often in old valley bottoms now dry.⁶ Two late Neolithic sites have been found in the central Sahara where figures have been carved on flat rocks at the bottom of wadis,⁷ perhaps indicating that the climate was already deteriorating well before the beginning of the Roman occupation. Fossil drainage patterns cover all of North Africa where they have not been erased by wind erosion or dune drift. These are not the traces of wadis, but of permanent streams, many of them connecting with either the Niger or the Nile drainage systems.⁸

The Nile has of course minimized the effect of climatic changes on the fauna of its region, but there is some evidence of rainfall fluctuations in the changing levels of Lake Fayum.⁹ The lake was cut off from the Nile by the silting of its connection about 5000 B.C., or approximately at the opening of the Egyptian Neolithic. The water level was thus dependent on local rainfall until the connection was reopened about 2500 B.C. The lake terraces indicate that the level remained constant for at least two long periods during this time, and thus that the rainfall approximately equalled the evaporation, which is considerably more rainfall than the area receives at present.¹⁰ Evidence from Kharga Oasis shows a relatively wet Neolithic period in which culture sites were much more numerous than the present water supply would allow, and are even found on the now totally dry plateau.¹¹

Climatic change (including dry periods as well as wet) was apparently uniform over most of North Africa during the Pleistocene and prehistoric periods, and the fluctuations were on a very much greater scale than those of the last 2000 years. The wet periods probably coincided with ice advances in Europe and resulted from a consequent southward shift of the winter storm tracks (which now reach the

⁶ Gautier, 1921 and 1935b; Wulsin, 1941.

⁷ Gautier, 1926; Solignac, 1928.

⁸ The channels have in most cases run dry while still in their youthful stage, indicating perhaps only a short wet period. Their continued obliteration during the last 2000 years may well have reduced the effectiveness of the rainfall even with no change in its average annual amount.

⁹ See Caton-Thompson, 1934.

¹⁰ The evidence of the lake levels cannot be considered final, since varying rates of seepage and evaporation as well as unrecorded drainage changes may also have been important factors.

¹¹ Beadnell, 1909; Huzayyin, 1941; Caton-Thompson, 1932b. There is a measure of disagreement among these authorities on this point. Caton-Thompson suggests that the Neolithic inhabitants of Kharga were dependent for water primarily on what she describes as "fossil springs"—fissures in a surface or near-surface sandstone aquifer, caused by tectonic movements, and toward the end of the Neolithic gradually overwhelmed by drifting sand which as it solidified effectively capped the springs and forced the Neolithic agriculturists to evacuate the oasis, possibly to Egypt. She points to the absence of any karst formations or extensive weathering of the surface limestone at Kharga as evidence that rainfall there never reached even a Mediterranean climate level during the Pleistocene. According to her analysis, Neolithic sites at Kharga are related to the fossil springs and not to rainfall. Beadnell and Huzayyin however maintain that Kharga was inhabited by Neolithic agriculturists until the advent of the Persians in the fourth century B.C. and that they were dependent not only on springs but also on a rainfall greater than the Roman or the present. Wulsin (1941) tends to agree with Beadnell and Huzayyin on this latter point, at least as far as North Africa as a whole is concerned. Beadnell, 1933, reverses his earlier opinion (1909) that a lake had existed in Kharga oasis.

European shore of the Mediterranean) and/or from a northward extension of the East African monsoon (which now occasionally reaches the higher parts of the central Saharan massifs). A southern penetration of the westerlies would weaken the harmattan and allow a further northward extension of the monsoon. The increased warmth which apparently accompanied the wet periods would also increase the low-pressure area over North Africa and thus attract more rain-bearing storms. This pattern for the latter half of the Pleistocene in North Africa agrees fairly closely with climatic evidence for the same period from Europe (pollen analysis),¹² and from the United States (soil sections from western Texas),¹³ which provide a useful check based on quite different methods not practicable in North Africa. But changes of this order of magnitude have not continued into the historic period (where evidence must be assumed more plentiful), and we find only minor and conflicting evidence of even slight changes. The first step toward a solution of the riddle of the last 2000 years thus lies in an examination of the historical record of changes in human settlement, where we can at least find relatively firm ground. Do the facts of human change require us to assume climatic change?

CHANGES IN SETTLEMENT: THE HUMAN FACTOR

On the termination of the Third Punic War (146 B.C.), Rome acquired the lands of defeated Carthage, and by the time of the empire, Roman occupation had spread along the seaboard from the Atlantic coast of Morocco to the Nile delta, as well as including several Libyan and Egyptian oases. Large areas of the "granary of Rome" in northwestern Africa are now a desiccated wilderness. The great amphitheatre at El Djem, with seats for 60,000 people, stands in the desert surrounded by a few small Arab villages. The important Roman city of Timgad has been abandoned since about 250 A.D., while beside it is the clearly marked channel of a now vanished river. The Roman metropolis of Leptis Magna (near modern Tripoli, and now a ruins in the desert) was one of the primary commercial centers of the Roman Mediterranean, and the birthplace of the emperor Septimus Severus. Numerous Roman mosaics from these and other North African sites depict fauna now found only in tropical Africa. Ruins of great aqueducts and reservoirs dot the almost uninhabited plains of North Africa inland from the relatively better watered littoral. Roman remains in the oases of the Libyan and Egyptian deserts show that there was formerly a cultivated area many times larger than the present, together with large buildings and extensive irrigation works. Well-travelled roads, whose traces are now nearly obliterated by drifting sand, connected all of the Roman towns with each other and with the sea or the Nile.¹⁴ Roman Africa was a flourishing area which contributed an important part of the imperial capital's food supply, as well as

¹² Godwin, 1934.

¹³ Bryan, 1943.

¹⁴ The nature of the Roman-era climate is however suggested by the ruined Roman water stations at regular intervals of half a day's journey along most of these roads.

supporting a sedentary population greatly in excess of the present.¹⁵ The Byzantine successors to the Romans (including a Nestorian community in Kharga Oasis)¹⁶ ruled most of what the Romans had held in North Africa from 395 to 638 A.D., and while there was apparently a slight decrease in the amount of cultivated land, Byzantine architectural remains are equally imposing and show a high-level cultural and technical civilization based on sedentary agriculture in the oases.

Then the land use suffered a profound change. Arab conquest of the whole of North Africa during the seventh and eighth centuries A.D. was followed by mass immigration from Arabia (on the order of one million people). Agriculture was succeeded by nomadic herding, except for a few favored oases, and the region assumed essentially its present character. Mohammed was born into a century of widespread drought in Arabia, and the great period of Arab expansion which followed fits neatly into the argument for climatic change as the villain of the piece. Why else, it is argued, would the Arabs and their subject peoples in North Africa have abandoned a once profitable agriculture in an urban-based setting for the precarious and penurious existence of the nomad? Why else do we find irrigation works neglected, cultivated area greatly reduced or vanished, and a relatively primitive civilization over all of North Africa? Intermittent Arab records even give us factual evidence which seems to indicate a change in climate. They describe a gradual depopulation of large areas of North Africa between the ninth and the eighteenth centuries A.D., and state that by the twelfth century the Great Oasis (Kharga) was almost entirely uninhabited.¹⁷

Against this impressive array of undoubted facts, certain overriding considerations must be borne in mind. It cannot be proved that any part of North Africa is now or ever has been since Roman times incapable of supporting agriculture and settlement on a level approximately equal to Roman achievements, provided an equal amount of technical skill and economic organization was applied to it. The rivers of Algeria and Morocco still carry, in general, about the same volume of water as they did in Roman times, as evidenced by the fact that Roman bridges and fords are still adequate, and that the rivers are as navigable as they were then. Local exceptions, such as at Timgad, are fully accounted for by stream piracy or by silting.¹⁸ "Drying up" of Roman wells in all of the regions of North Africa where this has occurred has been due predominantly to neglect and to inferior technical skill, as numerous modern experiments have proved.¹⁹ It is recorded that on Hadrian's visit to Timgad in 133 A.D. rain fell for the first time in five years.²⁰ The elephants, and several other moister-climate species still found in Algeria during his reign, were exterminated by the fourth century A.D. in the search for wild

¹⁵ See Baradez, 1949, for air views of Roman remains.

¹⁶ Nestorius was banished to Kharga in 434 A.D.

¹⁷ Huntington, 1910.

¹⁸ Gsell, 1902.

¹⁹ Ahlmann, 1928; Bovill, 1929; Beadnell, 1909; Lahache, 1900; Robb, 1945.

²⁰ Gsell, 1921.

animals for the Roman games rather than as the result of progressive desiccation.²¹ The total yearly grain supply sent from all of North Africa to Rome, estimated as enough to feed about 350,000 people, is by no means impossible to produce for export under present conditions.²²

It seems clear that the deserted Roman cities are still potentially habitable, the rivers as big as when the cities were built, and the droughts as frequent. The experiences of the French in their relatively brief effective control of Algeria and Tunisia tend to bear this out,²³ and many oases and deserted Roman fields are being reclaimed for agriculture. An interesting piece of evidence resulted from the French attempt to expel the Tuareg from the Aïr in 1917. As the population decreased, wells, gardens, and stock were allowed to deteriorate, and within less than a year the area looked exactly like other areas which have been used as evidence of progressive desiccation.²⁴ In this connection, it seems likely that the diversion of trade routes away from the Sahara and the Mediterranean shore of Africa to the West African coast in the last two hundred years, especially with the decrease or disappearance of the trade in slaves and salt, has contributed significantly to the economic deterioration of North Africa and its inevitable result in the neglect of water resources.

It is entirely possible that with continued French administration and technical assistance, her North African provinces may regain the economic level they reached under the Romans. Exploitation on the Roman scale might not now be economic when the production of other more favored areas competes on the world market and when French capital is more advantageously used elsewhere, but the physical potential is clearly far in excess of current utilization. The soil of northwest Africa remains potentially as productive as it was under the Roman occupation, and lacks only irrigation. Under the more recent Italian administration of Libya and Tripolitania, research and development have not yet progressed far enough to give an adequate indication of the possibilities of restoring Roman achievements in the great oases, but the work, inter alia, of French, British, and Egyptian geologists has shown that they exist.²⁵

The Romans were an agricultural people who expanded into their Mediterranean empire from a relatively humid base in Italy. It was natural that they should extend this approach to the natural environment into their African provinces.²⁶ The Arabs were on the contrary a nomadic people, nurtured in the true desert of Arabia,

²¹ Ibid.

²² Baradez, 1949; Laurent, 1857; Robb, 1945; Vogt, 1943.

²³ Ibidem; Gautier, 1935b; Monod, 1938.

²⁴ Bovill, 1929.

²⁵ Ball, 1900, 1902, 1903, 1939; Beadnell, 1901, 1908, 1909; Boak, 1926; Laurent, 1857; Robb, 1945; Rolland, 1886 and 1887.

²⁶ The Romans were anxious to make use of Carthaginian experience with irrigated agriculture, and had Mago, a Carthaginian writer on agriculture, translated into Latin by a senatorial commission soon after the fall of Carthage. (Pliny, *Historia Naturalis*, 18-22.)

and totally unused to an agricultural economy.²⁷ Their technique was unequal to understanding or managing the highly-developed irrigation works of North Africa bequeathed to them by the Romans, and they had no need for dependence on the agriculture which these works had supported. Their different use of the land does not need to be explained by a change in climate.²⁸ No military conquest is conducive to the maintenance of civil order nor the administrative and technical organization which an intricate irrigation economy requires, especially when the conquerors are nomads. The Arab conquest destroyed the Roman irrigation works, or allowed them to deteriorate, and established in their stead a nomadic pastoral economy over most of North Africa, implemented by the wholesale introduction of the camel between the sixth and seventh centuries A.D.²⁹ Similar well-documented cases, for example, the Masai, are recorded from East and West Africa, where Hamitic or semi-Hamitic peoples in later ripples of the Islamic invasion displaced or overlaid sedentary Negro agriculturists and substituted nomadic herding in areas where the only change was in social and economic custom rather than in the natural environment.

Nevertheless, it is possible that the changed land use which the Arabs brought with them did in time affect the natural environment in a critical way. By the end of the eighth century A.D. there were approximately one million Arabs in North Africa. Each Arab family kept a large flock of sheep and goats, variously estimated at between fifteen and fifty per family.³⁰ Goats are notoriously close croppers, and their unrestricted grazing in the Mediterranean area has had a virtually irreparable effect. In North Africa too, the added presence of several million goats undoubtedly destroyed large areas of grass, scrub, and trees, increasing the run-off, decreasing precious supplies of groundwater and lowering the water table perhaps critically, adding to the erosion of water courses, and disrupting the optimum distribution of surface water. Perhaps in some regions goats may have removed the ground cover sufficiently to increase reflection of the sun's rays and produce an increase of violent convection showers, whose effect is largely wasted, as has since happened in parts of South Africa.

Contemporary Arab disrespect for trees (notorious in both Arabia and North Africa) except as lumber or firewood, and lack of understanding of the long-term

²⁷ The water-control works of the Moors in Spain might constitute an exception, but the need for and means of irrigation are much clearer in Spain than in North Africa. The Arab migrants to North Africa seem to have been recruited from the desert area of Arabia rather than from the relatively better watered regions of Yemen and the Hadhramaut, where irrigated agriculture is very old (see Caton-Thompson, 1939). The exodus from Arabia at this period may well have been due to a dry phase of the climatic cycle which removed the slim margin of existence in the Arabian desert but did not drastically affect the irrigated agriculture further south. The migrants probably had no detailed knowledge of irrigated farming as practised by their sedentary compatriots.

²⁸ The dry phase of Mediterranean climate is of course suitable for either irrigated farming or for nomadic or semi-nomadic herding. Both sorts of land use are currently practised in virtually identical climatic regions of the Mediterranean basin.

²⁹ See Wulsin, 1941, p. 108. See above, p. 118.

³⁰ Boudy, 1947; Ward-Perkins, 1950.

value to themselves of tree-cover may suggest a further deteriorating effect of Arab land use on the productivity of North Africa. Indeed, one student of the problem, while agreeing that the North African climate has not changed significantly in the last 2000 years, states that the primary cause of the economic decline during that period has been deforestation, for which he lays the blame at the door of the Arabs.³¹ While in the absence of any considerable forest cover in North Africa during the historic period it is difficult to accept this judgment at face value, it is certainly possible that Arab destruction of "non-productive" trees (i.e., excluding date palms, whose value was apparent even, or especially, to the Arabs) had an important effect on the depletion of groundwater resources and in the removal of wind-breaks protecting cultivated fields and wells against drifting sand.

One further indirect effect of Arab occupancy on the natural environment is possible in the apparent increase of malaria in North Africa since Roman times. Malaria is a grossly debilitating disease which has been blamed for the fall of Rome itself as well as for the low technical level of civilization in many areas where it is endemic. *Anopheles* may have found increased breeding places in the stagnant waters of disused Roman irrigation systems, isolated reservoirs, or streams truncated by erosion, all conditions perhaps ultimately traceable to the effects of the Arab invasion. A population whose energy and initiative have been sapped by endemic malaria, as Arab North Africa appears to have been to a greater extent than Roman North Africa, is still less adequate for the specialized work of maintaining the intricate technical and organizational system of irrigation agriculture.

To blame the human or economic deterioration of North Africa on climate absolutely requires the occurrence of progressive desiccation. Fluctuations periodically returning to the mean may, and doubtless did, have serious local or temporary effects, but they cannot and could not be responsible unaided for the destruction of a highly effective technical civilization and its replacement by a technically greatly inferior one based on a totally different type of land use. The end of Roman occupation may have coincided with a temporary dry period which accentuated political and economic difficulties to a critical point; but Roman rule in North Africa was succeeded by Byzantine and Nestorian occupancy on an agricultural basis and on a level of civilization approximately equal with the Roman. If its fall was also hastened by a temporary dry period, agricultural occupancy would have recommenced under the new rulers, if they had been capable or willing to do it, unless genuine progressive desiccation had made this impossible. In the absence of reliable meteorological evidence for or against progressive desiccation since Roman times, we are obliged to rely on the indirect geological evidence, which will now be summarized.

THE EVIDENCE OF THE OASES

The greater part of Libya and of Egypt west of the Nile is underlain by sandstone strata with a slight downward tilt toward the north. These strata average

³¹ Ward-Perkins, 1950.

between 300 and 800 feet in thickness, and are predominantly aquiferous. Where the wadis converge in the great depressions in which the desert oases are situated, the aquifer is within 80 to 100 meters of the surface, and when drilled yields naturally flowing cold water, in most cases with a pressure head. The Nile is the most likely source of this water, since between Khartoum and Wadi Halfa it flows through a long reach of Nubian sandstones which are conformable with the Libyan and Egyptian strata.³² The water can be tapped economically only in the oasis depressions, and in all of the oases there are Paleolithic and Neolithic remains, as well as Roman structures and the signs of past or present Arab occupation. The Romans were the first people to use the deeper groundwater resources on a large scale, although the invention of the artesian well is locally attributed to Alexander the Great, and Caton-Thompson suggests that it was the Persians who first tapped the sub-surface aquifer at Kharga in the fourth century B.C.³³

The Romans, as already indicated, supported a large population by irrigated agriculture in the oases. Roman Kharga produced a rich revenue from trade, as well as from its exports of grapes, dates, wheat, and barley, and the same seems to have been true on a somewhat smaller scale of Baharia, Dakhla, and Farafra.³⁴ The size and number of Roman buildings in these oases, the irrigation works, and the traces of Roman cultivation all demonstrate a total population and an extent of agricultural acreage far in excess of the present. Byzantine records of the fifth century A.D. describe Kharga as producing two crops of barley and three of millet per year, plus rice and dates, with the aid of "copious irrigation water," but in a climate of "cloudless skies and no rain."³⁵ On the other hand, Arab records of the eleventh and fifteenth centuries A.D. show the oasis virtually uninhabited and of little importance.³⁶ The journals of a French traveller at the end of the seventeenth century describe the local climate and land use in much the same terms as the present, and the more detailed reports of several nineteenth century expeditions give a similar account.³⁷ The population and cultivated area of the oases have at all periods clearly been related directly to the water supply. Has this supply decreased because of a change in climate?

The ruins of Roman irrigation works in these oases are impressive. The great majority of all the oasis wells date from Roman times, and are remarkably well preserved. Most of them are artesian, but in some of the smaller oases the water must be lifted a few feet. Irrigation channels lined with rock or acacia wood, many of them now broken and dry, lead from these wells and from many others now abandoned to the small fields now tilled by the oasis dwellers and to the remnants of abandoned Roman fields. In the larger oases, notably at Kharga, the Romans

³² Beadnell, 1909; Sandford, 1933.

³³ Caton-Thompson, 1932b.

³⁴ See Beadnell, 1909, et al.; Graham, 1902.

³⁵ Beadnell, 1909, p. 107.

³⁶ *Ibid.*; Huntington, 1910.

³⁷ Beadnell, 1909.

also constructed underground channels,³⁸ many of them through solid rock, in order to concentrate water from the surface and near-surface sandstone aquifers and to convey it laterally to cultivated land at different levels.³⁹ It is reasonable to suppose that the water obtained was worth the effort and expense. None of these underground irrigation channels were apparently used by the Arabs, and they were allowed to silt up or collapse following the Arab conquest of the seventh century A.D. However, one of the channels at Kharga was cleaned out in 1908 as an experiment, and a constant flow was obtained sufficient to irrigate twelve new acres of farm land.⁴⁰ Abandoned Roman wells are far more numerous in all of the oases than currently used wells. In some cases these older disused wells have become silted up or their sidewalls have collapsed, but in many cases they have apparently been abandoned only because they have lost their artesian head and the water must be lifted. The present Arab inhabitants do not use water-lifting devices, and they refuse to draw water from wells which no longer flow naturally. Local evidence and Arab records indicate that almost no new wells were dug between the end of Byzantine rule and the middle of the nineteenth century, during which time many of the Roman wells were allowed to deteriorate.⁴¹ Experimental cleaning of several abandoned Roman wells has produced a good flow, in most cases with a pressure head. Yet Arab abandonment of towns and even of whole oases has apparently continued at every period since the end of Byzantine occupation. The old Roman town of Beris in the oasis of Kharga was abandoned as recently as 1850.⁴²

The Arabs have clearly not made as effective use of the groundwater resources of North Africa as did the Romans, and have depended largely on a shifting animal economy. The lack of Arab attention to the constant maintenance needs of an irrigation economy is understandable considering their environmental background, but it may as already indicated have been intensified by the spread of malaria from stagnant water in disused irrigation channels and wells. In Roman times the oases were considered health resorts. Certainly the contemporary *fellahin* inhabitants do not exhibit the energy, let alone the technical skill, for the restoration or maintenance of the ruined irrigation works amid which they live, "eyeless in Gaza."

Haphazard and extensive drilling since 1850 also seems to have decreased the flow of water from the best located wells. The present inhabitants do not understand the science of hydraulics, and have destroyed the pressure head of many wells by drilling others too close to them. As a result, both wells may be abandoned, since the Arabs refuse to use water-lifting devices. That a pressure head still exists in the aquifer is apparent from the great increase in flow obtained from wells which

³⁸ Caton-Thompson, 1932b, suggests that the earliest of the channels at Kharga were constructed by the Persians in the third and fourth centuries B.C.

³⁹ See Beadnell, 1909, for a detailed description of these channels.

⁴⁰ Beadnell, 1909, p. 146.

⁴¹ Beadnell, 1909.

⁴² *Ibid.*, p. 234.

are stopped up for a few days and then reopened, an increase often amounting to as much as 75 per cent.⁴³ The Geological Survey of Egypt is convinced that greatly increased amounts of water could be obtained for irrigation in the oases, on a permanent basis. We have no means of measuring with any accuracy whether the potential water supply is as great as it was in Roman times, but it is clearly far above the present level of use and could conceivably still support as extensive a settlement as the Roman. It is of course possible that Roman drillings and subsequent Arab use and misuse have depleted the groundwater resources; indeed it must be assumed that this has occurred in some degree, when the probable effects of Arab land use on the water table are considered. This does not mean that the climate has changed.

Two further non-climatic factors must be considered in evaluating the changed productivity of the oases. First, the relationship between the rate of flow of the wells and the absolute ground level, which may well have altered during the past 2000 years. If the ground level was raised only three meters in Kharga oasis, none of the wells would flow naturally.⁴⁴ Aeolian deposition of sand and finer materials, which form the surface layer of most of the area, has certainly continued throughout the historic period. Unfortunately the pattern of these surface layers has not been subjected to geological analysis in any detail, but it is more than possible that continued net deposition has taken many wells out of production, by removing their artesian head, and led to the abandonment of cultivated fields, especially with the Arab prejudice against water-lifting devices. Second, wind-blown sand and dune encroachment are constant dangers to agriculture here, as in all desert areas where rainfall is inadequate for vegetation to anchor dunes, or to act as windbreaks against blown sand. The Romans planted windbreaks of tamarisk around their fields (which they carefully kept watered), and apparently even extended tamarisk plantings to the tops of the dunes.⁴⁵ The tamarisks have long since vanished under the advancing sand after the Arabs discontinued Roman practices. Many wells have been buried, and many others are now threatened, in addition to the overwhelming of many Roman fields.

In summary, while there is no reliable evidence of important changes in the climate of Egypt or Libya since Roman times, there are ample indications that the decline in the productivity of the oases has been profoundly affected by non-climatic or human factors, and that much of the Roman prosperity could even now be regained by an equally effective utilization of the groundwater resources.

CONCLUSION

Despite the scantiness of adequate meteorological evidence, the theory persists that deteriorating climate has been responsible for the poverty of North Africa. The work especially of Huntington merits a brief discussion. His *World Power*

⁴³ Beadnell, 1901b, p. 5.

⁴⁴ Beadnell, 1909, p. 132.

⁴⁵ Beadnell, 1909, p. 132; Ball, 1939.

and *Evolution* suggests that Graeco-Roman civilization flourished during a period of increased rainfall from 500 B.C. to 200 A.D., and that its decline was directly due to a return to drier conditions. Without necessarily accepting his evidence, we may agree *a priori* that the climate has not been entirely uniform. Climate never is, and its fluctuations are usually reflected in human adaptations. But fluctuation does not equal progressive desiccation, however critical it may be for a given short period, and we have seen that progressive desiccation is essential to the theory that climate is responsible for the decline of North Africa. Huntington suggests that the present period is drier than the Roman (on evidence which cannot be considered adequate), but that successive fluctuations (including periods both wetter and drier than either the Roman or the present) have occurred throughout the last 2000 years which have been closely related to land use. This last cannot be disputed, but the evidence suggests that these undoubted fluctuations are, first, not measurable to the extent which Huntington implies, and second, that they were not primary causative factors in the progress of human settlement.

Conquest and political disintegration may join with economic decay to greatly intensify the effects of a temporary dry period, as happened repeatedly in central Asia. But climatic fluctuations alone, on the scale which Huntington assumes, are not a likely first cause of North Africa's lean years. If it were so, would we not find that the fluctuations claimed by Huntington (dry periods in about the fifth, seventh, twelfth, and fourteenth centuries A.D., interspersed by wet periods) disrupted the Byzantine and Arab empires as they had wrecked the Roman empire, according to his argument, or at least significantly altered Byzantine and Arab land use?⁴⁶ There is no evidence that these fluctuations, if indeed they occurred in time and amount as Huntington suggests, were accompanied by significant changes in North African land use, at the outset of Byzantine agricultural occupation, or under the Arabs, and it is therefore reasonable to suppose that they were not primarily responsible for the permanent change from agriculture to nomadism. In any event, even as Huntington shows them, the fluctuations since 200 A.D. do not amount to progressive desiccation.

The degree of climatic fluctuation suggested by Huntington is also suspect on theoretical meteorological grounds. North Africa is in a neutral position meteorologically between pressure, wind, and storm zones; less climatic fluctuation is to be expected here than in other areas meteorologically more positive.⁴⁷ Admittedly only slight changes in the amount of precipitation may be crucial in this arid area, but such slight changes cannot be measured with any accuracy for the period since the Roman occupation. The indirect evidence on which we are obliged to rely indi-

⁴⁶ See his graph labelled "Climatic Pulsations of Historic Times," based on an analysis of annual growth rings of the sequoias in California, Huntington, 1919, p. 188.

⁴⁷ Brooks, 1949, p. 408. Successive advances and retreats of the ice in Europe were probably responsible for the climatic changes in North Africa during the Pleistocene, but North Africa's meteorological neutrality was regained with the last retreat of the ice and has not yet been disturbed again.

cates that although fluctuations in the North African climate may well have occurred during the last 2000 years, their effect on human settlement was not of sole or lasting importance. This is particularly clear in comparing the only two periods for which we have detailed information, the Roman and the present.

There is great danger, especially in geographical analysis, of over-explaining the causes of any cultural phenomenon. In this enquiry, we have followed in the main one line of explanation—the human factor—primarily because in the absence of reliable climatic data, the evidences of human settlement provide a more practicable course of argument. There is no assumption here that the climate has not changed from time to time, as indeed it most certainly has done in greater or less degree. The question posed is whether climatic change has been responsible for the decline of North Africa since the Roman occupation. It is hoped that the evidence presented and the evaluation of that evidence has shown that man and his works have been in themselves factors adequate to explain what has happened.

SELECTED BIBLIOGRAPHY

- Ahlmann, Hans, 1928, "La Libye Septentrionale: Études de Géographie Physique et Humaine," *Geografiska Annaler*, I, No. 2: 1-18.
- Arago, Francois, 1855, *Meteorological Essays* (transl. Sabine), London.
- Ball, John, and Beadnell, H. J. L., 1903, *Baharia Oasis*, Ministry of Public Works, Cairo.
- Ball, John, 1939, *Contributions to the Geology of Egypt*, Cairo.
- 1900, *Kharga Oasis*, Ministry of Public Works, Cairo.
- 1902, *The Oasis of Kurkur*, Ministry of Public Works, Cairo.
- Baradez, Jean, 1949, *Vue-aerienne de l'organisation Romaine dans le sud-Algérien*, Paris.
- Beadnell, H. J. L., 1909, *An Egyptian Oasis*, London.
- 1901a, *Dakhla Oasis*, Ministry of Public Works, Cairo.
- 1901b, *Farafra Oasis*, Ministry of Public Works, Cairo.
- 1933, "Remarks on the Prehistoric Geography and Underground Waters of Kharga Oasis," *Geographical Journal*, LXXXI: 128-139.
- 1908, "The Water Supply of Kharga Oasis," *Geological Magazine*, V: 249.
- Berg, Lev Semenovich, 1914, *Das Problem der Klimaänderung in Geschichtliche Zeit*, Berlin.
- Boak, A. E. R., 1926, "Irrigation and Population in the Faiyum, the Garden of Egypt," *Geographical Review*, XVI: 353-364.
- Boissier, Gaston, 1895, *L'Afrique Romaine: Promenades Archéologiques en Algérie et en Tunisie*, Paris.
- Boudy, Louis, 1947, "Considérations sur l'évolution du climat en Afrique du nord, et en particulier au Maroc, depuis la période historique," *Comptes Rendus, Société des Sciences Naturelles du Maroc*, VII: 46-54.
- Bovill, E. W., 1929, "The Desiccation of North Africa," *Antiquity*, III: 414-424.
- Brooks, C. E. P., 1949, *Climate Through the Ages*, London.
- 1922, *The Evolution of Climate*, London.
- Bryan, Kirk, 1943, "Soil and Climatic Evidences," *American Journal of Science*, CCXLI: 469-490.
- Caton-Thompson, Gertrude, 1931a, "Kharga Oasis," *Antiquity*, V: 221-226.
- 1931b, "... Kharga Oasis . . .," *Man*, XXXI: 76-84; continued in XXXII: 129-135 (1932).
- and Gardner, E. W., 1939, "Climate, Irrigation, and Early Man in the Hadhramaut," *Geographical Journal*, XCIII: 18-35.
- and ——— 1934, *The Desert Fayum*, London.

- and ——— 1932b, "The Prehistoric Geography of Kharga Oasis," *Geographical Journal*, LXXX: 369-409.
- Diodorus Siculus, with an English Translation by C. H. Oldfather, The Loeb Classical Library, London, 1933-1939.
- Gardner, E. W., 1935, "The Pleistocene Fauna and Flora of Kharga Oasis," *Quarterly Journal of the Geological Society*, XCI: 423-428.
- 1932, "Some Problems of the Pleistocene Hydrography of Kharga Oasis," *Geological Magazine*, LXIX: 386-421.
- Gautier, E. F., 1926, "The Ahaggar," *Geographical Review*, XVI: 378-384.
- 1935a, "The Ancestors of the Tuaregs," *Geographical Review*, XXV: 12-21.
- 1921, "Nomad and Sedentary in North Africa," *Geographical Review*, XI: 3-12.
- 1937, *Le Passé de l'Afrique du nord: Les Siècles Obscurs*, Paris.
- 1908, *Sahara Algérien*, Paris.
- 1935b, *Sahara, The Great Desert* (transl. Mayhew), New York, 1935. (The original French edition of this work, *Le Sahara*, was published at Paris in 1923.)
- 1934, "The Tomb of Tin Hinan," *Geographical Review*, XXIV: 438-444.
- Godwin, H., 1934, "Pollen Analysis: An Outline of the Problems and Potentialities of the Method," *The New Phytologist*, XXXIII: 278-305; 325-358.
- Graham, Alex, 1902, *Roman Africa*, London.
- Gsell, Stephane, 1921, *Histoire Ancienne de l'Afrique du Nord*, Vol. I, Paris.
- 1901, *Monuments Antiques de l'Algérie*, Paris.
- 1902, *Sur les Travaux Hydrauliques Anciens en Algérie*, Paris.
- 1933, "La Tripolitanie et le Sahara au IIIème Siècle de Notre Ère," *Mémoires de l'Institut National de France, Académie des Inscriptions et Belles Lettres*, XLIII, part I: 149-166.
- Hellman, Gustav, 1916, "Über die Ägyptischer Witterungsangaben im Kalendar von Klaudius Ptolemaeus," *Preussen Akademie der Wissenschaft, Sitzungsberichten*, XIII: 332-341.
- Hubert, Hugo, 1920, "Désèchement Progressive en Afrique Occidentale," *Bull. Comm. A.O.F.*
- Huntington, Ellsworth, 1924, *Civilization and Climate*, New Haven, Conn.
- 1922, *Climatic Change* (with S. Visser), New Haven.
- 1910, "The Libyan Oasis of Kharga," *Bulletin of the American Geographical Society*, XLII: 641-654.
- 1945, *Mainsprings of Civilization*, New Haven.
- 1905, *The Pulse of Asia*, New Haven.
- 1919, *World Power and Evolution*, New Haven.
- Hussanein Bey, A. M., 1925, *The Lost Oases*, London.
- Huzayyin, S. A., 1941, *The Place of Egypt in Prehistory*, Cairo.
- Jones, B., 1938, "Desiccation and the West African Colonies," *Geographical Journal*, XCI: 401-423.
- Keane, A. H., 1920, *Man Past and Present*, Cambridge.
- Kendrew, W. G., 1932, *The Climates of the Continents*, Oxford.
- Killiam, Conrad, 1934, "Le désèchement du Sahara à l'époque historique," *L'Anthropologie*, XLV: 215.
- Knock, Karl, 1930, *Klima und Klimaschwankungen*, Leipzig.
- Lahache, J. E., 1900, *Étude hydrologique sur le Sahara français oriental*, Thèse, Paris.
- Laurent, Charles, 1857, *Notice sur le Sahara oriental au point de vue de l'établissement de puits artesiens*, Paris.
- Lavauden, Jean, 1926, "Sur la présence d'un cyprès dans les montagnes du Tassili," *Comptes Rendus de l'Académie des Sciences*, CLXXXII (February): 541-543, Paris.
- Little, O. H., et al., 1933, "Further Remarks on the Kharga Oasis," *Geographical Journal*, LXXXI: 526-532.
- Lyons, H. G., 1906, *The Physiography of the River Nile and its Basin*, Cairo.

- Mascart, Jean, 1925, *Notes sur la variabilité des climats*, Lyon.
- Monod, Theodore, 1938, *Contributions à l'étude du Sahara occidental*, Vol. I, Paris. (Vol. II was published at Paris in 1939.)
- 1936, "Les lacs fossiles du Sahara occidental," *L'Anthropologie*, XLVI: 212.
- Péllégrin, Jean, 1911, "Les Vertébrés aquatiques du Sahara," *Comptes rendus de l'Académie des Sciences*, CLXV (November): 972-974.
- Poulluge, Ludwig, 1880, *Klimaänderung in Historischen Zeiten*, Berlin.
- Rawlinson (ed.), 1928, *The History of Herodotus*, London.
- Reygasse, Maurice, 1940, *Fouilles des Monuments Funéraires du Type "Chouchet" Accolés au Tombeau de Tin Hinan*, Extrait du Bulletin de la Société de Géographie et d'Archéologie de la Province d'Oran, Vol. 61, Oran.
- Robb, R. L., 1945, *Survey of Land Resources in Tripolitania*, British Military Administration, Department of Agriculture, Tripoli.
- Rolland, M. G., 1886, *Hydrographie et Orographie du Sahara Algérien*, Extrait du Bulletin de la Société de Géographie, Paris.
- 1887, *L'oued Rir' et la Colonisation Française au Sahara*, Extrait de la Revue Scientifique, Paris.
- Sallust, *Bellum Iugurthinum*, Loeb Classical Library, London, 1920.
- Sandford, K. S., 1933, "Geology and Geomorphology of the Southern Libyan Desert," *Geographical Journal*, LXXXII: 213-229.
- Semple, E. C., 1931, *Geography of the Mediterranean Region*, New York.
- Sherwin-White, A. N., 1944, "Geographic Factors in Roman Algeria," *Journal of Roman Studies*, XXXIV: 1-10.
- Solignac, Marcel, 1928, *Les Pierres Écrites de la Berberie Orientale*, Tunis.
- Stebbing, E. P., 1937, "The Threat of the Sahara," *Journal of the Royal African Society*, Supplement to Vol. 36, May 25, 1937.
- Tousson, Prince Omar, 1909, *Mémoire sur l'Histoire du Nil*, Cairo.
- Vogt, Johannes, 1943, *Rom und Karthago*, Leipzig.
- Ward-Perkins, J. B., 1950, "Gasr es-Suq el-Oti; a Desert Settlement in Central Tripolitania," *Archeology*, III: 25-30.
- Wulsin, F. R., 1941, *The Prehistoric Archeology of Northwest Africa*, Papers of the Peabody Museum, Harvard University, Vol. 19, No. 1.

POINT FOUR AND MINERAL RAW MATERIALS

BRUCE CARLTON NETSCHERT

EVER since January 20, 1949, when President Truman proposed his Point Four—"a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas"—there has been considerable discussion of its merits, its feasibility, and its implications. The modest beginning to a Point Four program which has recently been made has not put an end to the controversy. It is timely, therefore, to point out an important aspect of the Point Four concept which has generally been overlooked: its significance as a possible factor in the future course of United States investment in foreign mineral production, in the light of the strategic mineral position of this country.

It is true that the recent report of the International Development Advisory Board¹ emphasizes the need of aiding private investment in raw material production to assure the free world and its principal arsenal, the United States, of the necessary supply of those materials in the effort to maintain that freedom. Nevertheless, emphasis is on immediate or short range needs, whereas the argument to be developed in this discussion stresses a problem which would confront us even if the current threat of totalitarianism were to disappear.

Under the ideological stresses of the cold war it is tempting to picture Point Four as a completely altruistic proposal which demonstrates to the world the unselfishness of this country in its concern for the well-being of mankind. A realistic appraisal of the program, however, recognizes that it is, like the European Recovery Program, an act of enlightened self-interest. A world which enjoys a higher standard of living will have greater political stability, will possess a greater purchasing power to spend on this country's exports, and, most important for the present discussion, will increase the world's available supply of raw materials through an increase in productive efficiency and the availability of capital.²

In the Russian point of view the self-interest of this country inherent in Point Four is so exaggerated as to make the program nothing more than a form of disguised imperialism. It is possible, however, to discuss the self-interest aspect of Point Four in terms of a *quid pro quo* without implying that this country seeks to gain any unjust advantage through the imposition of onerous terms on a beneficiary. The following discussion seeks to demonstrate that in the field of mineral raw materials the self-interest of the United States lies in an expansion of the world supply of those minerals in which this country is or will be deficient; that in the absence of Point Four assistance in this field there may be an insufficient expansion or none at all.

¹ International Development Advisory Board, *Partners in Progress*. Mimeographed edition, Washington, March 1951.

² Cf. *Ibid.*, pp. 44f.

A conspicuous feature of post-war discussions of the United States mineral situation has been the emphasis on declining reserves versus increased consumption. According to the surveys made during the war by the Geological Survey and the Bureau of Mines, this country faces an actual or impending reliance on imports for at least part of its needs of the following mineral raw materials:³

Antimony	Lead
Arsenic	Manganese
Asbestos	Mercury
Bauxite	Mica
Bismuth	Nickel
Cadmium	Platinum metals
Chromite	Quartz crystal
Cobalt	Tantalum
Copper	Tin
Fluorspar	Tungsten
Graphite	Vanadium
Industrial diamonds	Zinc
Iron	

The inclusion of many of the items in the above list is, of course, a matter of opinion as to the reliability of reserve estimates, the existence of undiscovered deposits, and the future level of demand. In addition, as the agencies themselves point out, future advances in technology and changes in general economic conditions could make important changes in the list.

The present discussion, however, is not concerned with the degree of future self-sufficiency of the United States with respect to individual items. It is concerned with certain implications inherent in the assumption that the general mineral self-sufficiency of this country will decline in the long run. If future mineral needs are to be met increasingly by imports, the question arises as to what the future course of American foreign investment in mineral production will be.

In considering this question it is all too easy to become guilty of anthropomorphism—to say that if the “United States” needs certain mineral imports, the “United States” will assure itself of sources of supply by investing in the development of new sources and by acquiring control of sources already developed. This attitude is typified by the following statement concerning the previous course of American foreign investment in minerals:⁴

... in so far as the problem of raw materials has become an acute problem for the United States, it may be said to be a development of the period since 1910. This same period has been marked by the growth of American foreign investments. These coincidental developments are not to be wondered at because of the obvious fact that one of the purposes of foreign investments is to secure certain, cheap, accessible and independently controlled sources of raw materials.

³ United States Bureau of Mines and United States Geological Survey, *Mineral Resources of the United States*. (Washington: Public Affairs Press, 1948), p. 12.

⁴ Edward M. Earle, “International Financial Control of Raw Materials,” *Proceedings of the Academy of Political Science*, XII, No. 1 (July 1926): 188.

It should be remembered, however, that is not the "United States" as a country which does the investing, but individuals and corporations. In fact, the mere existence of a dependence by domestic industry on foreign sources of supply does *not* ensure that investment will take place. Other factors must be taken into account before it can be said that the investment will occur more or less inevitably.

The occurrence of foreign investment is basically dependent on the availability of capital and the expected rate of return on that capital if so invested. The Point Four concept assumes that there is and will be ample available capital in this country. By definition, the expected rate of return on foreign mineral investments in underdeveloped countries can be expected to exceed that obtainable from alternative domestic uses of capital.

In addition, the occurrence of foreign investment is influenced by the degree of risk, which is determined by the political and economic conditions of the country in which the properties to be developed or acquired are located. On the unfavorable side are such factors as the risk of property destruction through violence and revolution, of expropriation as the result of a change in government policy subsequent to the investment, restrictions on the movement of capital into and out of the country, and hindrances to the transfer of earnings on investments in the form of exchange control or instability in the foreign exchange markets. On the favorable side are governmental policies designed to attract foreign capital through special tax provisions or guarantees of the right to transfer earnings.

The importance given to the risk element by the investor is largely determined by the motive behind the investment. "Independent" investment (i.e., investment for the purpose of producing for sale in the world or domestic U. S. market) is based solely on the anticipation of the profits to be derived therefrom, hence is easily discouraged by the risk element. On the other hand, investment can also be undertaken by a domestic concern already engaged in one or more of the stages of producing, processing, or manufacturing, for the purpose of providing itself with an import source of its basic raw material in either the raw or processed state. This vertical integration would be induced by a desire to make the concern independent of either a foreign processing industry or the vagaries of the world market for that raw material. The mere existence of such an "integration motive" for investment would considerably lessen the importance of the risk element; and the stronger the motive, the larger the risk the investor would be willing to discount so as to proceed with the investment.

A study of the history of investment in foreign mineral production during the present century reveals that most of the investment for the purpose of providing imports into the United States has been under the integration motive. Independent investment was a rare occurrence and involved comparatively small capital sums. On the face of it, this would seem to substantiate the attitude quoted above. The investment assumes an entirely different significance, however, when it is analyzed in terms of individual mineral commodities and the character of the United States trade in those commodities.

Statistics on the distribution of investment among the various mineral commodities are available for the year 1929. As Table I shows, total investment in foreign petroleum (exclusive of transportation and marketing) was greater than the total investment in all other minerals, and that in copper was greater than in all other minerals excluding petroleum. A survey of the mining journals and yearbooks from 1900 through 1945 indicates that this was the typical relationship throughout the period.

The significance of this investment distribution is best demonstrated in terms of a classification of mineral trade items which combines both the place of each commodity in United States mineral trade, and the type of trade in that commodity which took place during the 1900-1945 period.

TABLE I
U. S. FOREIGN INVESTMENT IN MINERAL PRODUCTION AND PROCESSING, AS OF 1929

	Investment (\$ million)	Per cent of total	Per cent of total exclud- ing petroleum
Total investment in petroleum (excluding transportation and marketing)*	1,663.8	63.3	
(Petroleum production only)	(854)		
Industrial minerals, excluding petroleum	965.3	36.7	
(Copper)	(555)	21.1	57.5
(Chilean nitrate)	(73)	2.8	7.6
(Aluminum)	(66.3)	2.5	6.9
(Nickel)	(50)	1.9	5.2
(Zinc)	(49)	1.9	5.1
(Lead)	(45)	1.7	4.7
(Iron and Ferroalloys)	(45)	1.7	4.7
(Tin)	(35)	1.3	3.8
(Coal)	(23)	0.9	2.4
(Asbestos and gypsum)	(17.5)	0.7	1.8
(Sulfur)	(6.5)	0.2	0.7
Total	2,629.1		

Sources: * Leonard M. Fanning (ed.), *Our Oil Resources* (New York: McGraw-Hill, 1945), p. 193.

Other value figures: Cleona Lewis, *America's Stake in International Investments*. (Washington: The Brookings Institution, 1938).

A rough classification of United State foreign trade in individual mineral raw materials can be made on the basis of the following criteria, considering each criterion relative to all the others as they pertain to a given mineral (See Table II):

- (a) Imports (quantity and total value)
- (b) Exports (quantity and total value)
- (c) Domestic production
- (d) Domestic consumption
- (e) The existence and size of a domestic processing industry

The *Exportable Surplus Trade* is characterized by a large excess of domestic production over domestic consumption, the excess supply serving as the basis for a

significant export trade. Imports during the period 1900-1945 were minor relative to items (b), (c), and (d), or were nonexistent. If there was a processing industry it was dependent on imports only slightly, if at all.

The *Processing Trade* is characterized by a domestic supply of the commodity sufficient for domestic needs, the existence of a large and important processing industry⁵ partially dependent on imports, a minor export trade in the raw material, but an important export trade in the processed material.

The *Deficiency Trade* is characterized by a domestic supply insufficient for domestic needs, significant imports, and negligible exports.

TABLE II
A CLASSIFICATION OF U. S. MINERAL FOREIGN TRADE

	Exportable Surplus Trade Items	Processing Trade Items	Deficiency Trade Items
Items of great importance	Coal	Copper Petroleum	Chilean nitrate Tin
Items of moderate importance	Iron Phosphate Rock Sulfur	*Aluminum *Lead *Zinc	Asbestos Chromite Industrial Diamonds Manganese Nickel Platinum minerals Potash Tungsten
Items of small importance	Cement Molybdenum Salt		Antimony Clays Cobalt Cryolite Graphite Iodine Magnesite Mercury Mica Quartz crystal Talc Vanadium

* Assigned to this category with qualifications.

Such a classification is bound to be rough, as it is based on crude distinctions. Not only are individual commodities assignable to different categories for different periods during the present century, but certain items are difficult to assign to any category even from an overall point of view. Aluminum trade, for example, possessed processing and deficiency trade characteristics to about the same degree. Lead and zinc trade, at least during the inter-war period, was on the borderline between the processing and deficiency categories. In each instance, however, the

⁵ "Processing" as used throughout the discussion refers to refining or smelting operations which produce a metal or industrial mineral for use as the raw material of a manufacturing operation. This excludes such "processing" as the production of tin plate from sheet steel, or of chemicals from mineral raw materials.

existence of a large, important processing industry was considered to override the trade ambiguities.

The place of a mineral commodity in total United States mineral foreign trade can be measured by its relative position among the 30 leading mineral imports and exports in yearly dollar value terms (See Table II). Items which were among the five leading mineral imports or exports more or less consistently between 1900 and 1945 are considered as items of "great importance". Those which were less consistent members of the 30 leading mineral trade items, but which individually accounted on the average for a maximum of 10 per cent of the total value of those items are termed items of "moderate importance". Those which appeared among the leading 30 only spasmodically, and individually averaged one per cent or less of the aggregate value of the 30 leaders for any given year are termed items of "small importance." This is also a crude classification, but together with the trade categories it will serve as a useful frame of reference.

A comparison of Table I with Table II reveals the following foreign trade-foreign investment relationships between 1900 and 1945: (1) Investment in exportable surplus trade items was on the whole minor. (2) Investment in processing trade items constituted the major portion of all foreign mineral investment. (Moreover, all of these items were of at least moderate importance in trade.) (3) Investment in deficiency trade items was relatively minor, although these items constituted a large portion of the import trade in total value terms and were almost two thirds of the total items making up the mineral foreign trade. These facts provide the basis for investigating the causal relationship between need and investment.

In the case of the exportable surplus trade items, the *a priori* conclusion of need breeding investment is upheld in at least a negative sense. There was little or no investment in the seven commodities in this category, with the exception of iron. The explanation of the latter lies in the character of the industry. The integration between iron processing (the production of pig iron) and consumption (the manufacture of pig iron into steel shapes) has always been unusually close and commonplace, and in addition, a portion of the industry has been based on an import trade despite the existence of potential domestic excess productive capacity because of certain geographical factors. In coal, on the other hand, as an example of the typical exportable surplus trade item, the integration motive to invest existed, but importers would have been consumers rather than processors.⁶ The tendency toward integration under these conditions is much weaker, since the very nature of the processing industry in minerals encourages integration. Thus it was only in iron that investment would be expected to occur to any extent and in which, in fact, it did occur.

The five processing trade items, however, tell quite a different story. With the exception of aluminum, imports of these items were not based on need, yet

⁶ The northeast and northwest sections of the United States are coal importers by virtue of differentials in transportation costs.

both the largest investment and largest portion of total mineral trade is found in this category. Indeed what "need" there was for imports of petroleum and copper existed in the face of a basic exportable surplus (in terms of domestic production vs. domestic consumption) of these items during most of the century.⁷ Moreover, this surplus was exported in the processed state, so that there also existed in this country with respect to each of the metals except aluminum a processing industry with excess capacity relative to domestic needs. This processing industry, founded on domestic production, but expanded beyond domestic consumption needs on the basis of acquired foreign sources of supply, was the reason for the major portion of both the import and export trade in copper and petroleum, as well as their dominance in all mineral trade. Once the expansion was accomplished, the surplus capacity could be maintained profitably only on the basis of continued imports, which required investment, which in turn led to the imports.

It is thus more than a coincidence that the amount and extent of foreign investment which took place in each commodity was roughly proportionate to the degree to which the domestic processing industry relied on foreign imports for raw materials and foreign markets for the sale of its product. The stronger the urge to invest under the integration motive, the larger the trade which resulted from the investment, and the greater became the dependence of that industry on imports.

The petroleum and copper processing industries relied to the greatest extent on imports, since they were well integrated on the basis of large foreign investment. The aluminum industry was less typical because of the ambiguous position of the domestic processing industry, which carried on the intermediate processing between raw material and the final refined product. In addition, the unusual monopoly structure of the industry made it possible for managerial decisions within a single corporation to decree this position rather than one similar to that in copper and petroleum (albeit based on less abundant domestic resources). The lead and zinc industries, on the other hand, were domestically self-contained and less integrated. There was thus little excess processing capacity based on foreign integration, and in turn a smaller trade because there had been less investment under the integration motive.

In terms of needed imports—that is, in terms of the inability of the domestic mining industry to produce the raw mineral product—requirements of the domestic processing industry were least in copper and petroleum throughout most of the period. In lead and zinc, domestic production ability and processing capacity were more nearly even, and in aluminum there was a definite deficiency in the former. With the exception of aluminum, investment leading to imports did not take place to remedy a lack of domestic production ability, but occurred as a part

⁷ Concerning petroleum: Herman Kranold, *The International Distribution of Raw Materials*. (New York: Harpers, 1937), p. 282.

Concerning copper: Percy Barbour, "The Copper Industry: A Reply," *Annals of the American Academy of Political and Social Science*, CL, July 1930: 113; and Robert Pettengill, "United States Foreign Trade in Copper: 1790-1932," *American Economic Review*, XXV, No. 3 (September 1935): 440.

of vertical integration to aid the growth of a domestic processing industry. The industry "needed" imports only to the extent that it had expanded on the basis of such imports beyond domestic consumption needs.

Turning to the deficiency trade category one finds within it almost two thirds of the items which constitute the mineral trade of this country, as well as all the ferroalloy metals except molybdenum. By definition, imports of these items were based on need for domestic consumption, a need which varied from a moderate to an absolute lack of domestic sources of supply. In no instance, however, was there a large processing industry with a capacity based partly on imports of raw materials.⁸

This lack of a domestic processing industry based to any degree on imports made the integration motive for foreign investment relatively weak. Integration, when it occurred, was generally between the stages of foreign production and domestic consumption, as in the case of coal cited above. The steel companies, for example, as domestic consumers of the ferroalloy metals, were much more easily deterred from investment in the foreign production or processing of those materials than in sources of iron, the raw material of their "processing" activity. The copper and oil processors, on the other hand, pressed their foreign investment activity in the face of great capital risk and other deterrents, since their very existence as an industry might depend on whether or not they controlled foreign sources of supply.⁹

A good illustration of this point is found in the history of investment in manganese versus that in oil and copper. Between 1900 and 1945 nearly 90 per cent of the yearly requirements of the steel industry for manganese, an indispensable raw material, were met by imports. Yet in 1913 the United States, although a major manganese consumer, controlled financially only 3.5 per cent of the world's production outside its borders, prompting an observer in 1920 to make the understatement that "Citizens of the United States have not shown great interest in purchasing foreign deposits of manganese ore."¹⁰ By 1929 control of foreign production had risen to 19 per cent of total foreign production¹¹ but this was still below what one would expect on the grounds that dependence on foreign sources breeds foreign investment.

In contrast, as of 1914 American-owned foreign production of petroleum was 13 per cent of total foreign production, and by 1929 the proportion had risen to 30 per

⁸ Thus the electrometallurgical industries which produce ferroalloys from imported ores are important in themselves, but are not large in comparison with the four other criteria listed with the processing industry.

⁹ The necessity of controlling a foreign source of supply to ensure sufficient business for the domestic processing industry is borne out by the trade statistics for copper and petroleum. The copper ore and crude petroleum produced by European companies in South America has tended not to come to American refineries.

¹⁰ J. E. Spurr (ed.), *Political and Commercial Geology*. (New York: McGraw-Hill, 1920), pp. 94, 105.

¹¹ Wm. P. Rawles, "The Nationality of Commercial Control of World Minerals," *The Mineral Inquiry* (New York, 1933), p. 24.

cent.¹² In copper, as of 1917 60 per cent of world production outside the United States was from American-owned foreign producers; by 1929 the proportion had become smaller, but was still about 50 per cent.¹³

In effect, the less compelling urge of the integration motive to invest in the mineral commodities of the deficiency trade category meant that disadvantageous circumstances were more of a hindrance to investment than they would have been had the commodity been in the processing trade category. Such factors as remoteness, local political circumstances, and the nature of the local industry in foreign countries assumed more importance as reasons for the lack of investment.

The common error of imputing a direct causal relationship between need and investment on the basis of *a priori* assumptions is well illustrated in the following quotation from a discussion of the ferroalloy minerals which appeared in 1926:¹⁴

There is a tendency, when steel-making nationals do not find a supply of necessary ferroalloy minerals in their own country, to acquire mines abroad, and thus insure a fixed and steady supply, which will be disrupted only in case of war so violent as to disrupt ocean traffic. Thus the vanadium deposits of Peru, the manganese deposits of Russia, the nickel deposits of Canada, the chromium deposits of Cuba have become controlled by American companies.

By making the *a priori* assumption that investment under such circumstances must inevitably be caused by need, that writer overlooked the significance of the fact that as items of trade, the ferroalloy minerals were all within what is here termed the deficiency trade category. The integration motive to invest, although present, was considerably weaker than the assumption would have it. Of the four specific investment instances which Spurr cited, only the case of the Cuban chromite deposits was an example of the working of the integration motive. The Peruvian vanadium deposit was developed before the American steel industry had established a need for it;¹⁵ the manganese investment in Russia was an "independent" venture by financiers;¹⁶ and the nickel deposits in Canada came under American control more or less by chance, again before there was any significant demand by American steel companies for nickel.¹⁷

Of the 25 minerals listed at the beginning of this discussion, the United States can be considered to have an existing domestic processing industry of any im-

¹² Leonard M. Fanning (ed.), *Our Oil Resources*. (New York: McGraw-Hill, 1945), pp. 17f.

¹³ J. E. Spurr, *op. cit.*, p. 541.

¹⁴ J. E. Spurr, "Steel-making Minerals," *Foreign Affairs*, IV, No. 4 (July 1926): 611. (Cf. also C. P. Rawles, *op. cit.*, p. 337; and U. S. Bureau of Foreign and Domestic Commerce, *The United States in the World Economy*, Economic Series No. 23, p. 102, for similar statements.)

¹⁵ Cleona Lewis, *America's Stake in International Investments*. (Washington: The Brookings Institution, 1938), p. 258.

¹⁶ J. S. Furness (untitled discussion), *Transactions of the American Institute of Mining and Metallurgical Engineers*, LXXV, 1927: 396.

¹⁷ Cleona Lewis, *op. cit.*, p. 252; and Herbert Marshall, Frank A. Southard, and K. W. Taylor, *Canadian-American Industry*, (New Haven: Yale University Press, 1936), p. 97.

portance in five: copper, iron, lead, tin, and zinc. With respect to copper, previous foreign investment has already assured the development of sources which can fill import needs in the foreseeable future. If present domestic submarginal reserves of iron remain submarginal, it will mean a change of that item from the exportable surplus trade category to the processing trade category. In the light of previous history, the present investment activity in Labrador and Venezuela will then turn out to be but the beginning of continued large investment activity in the future. If, on the other hand, this country maintains its general self-sufficiency with respect to iron ore, the present activity will be but another chapter in the history of iron as an exception to the exportable surplus trade category by virtue of the well integrated structure of the industry. To put it another way, the unusual stimulus toward foreign investment which has characterized the iron (ore) industry will be permanently reinforced if domestic self-sufficiency declines; otherwise, the current Labrador and Venezuelan investments will be merely exceptions to the general lack of investment in exportable surplus items, as were the Chilean and Cuban investments in the past.

Thus far there has been no such comparable post-war investment activity in foreign lead and zinc sources. But if the self-sufficiency of the United States with respect to these minerals declines there are two possible courses of investment activity: (a) A strong bid for survival by that portion of the lead and zinc processing industries which may become surplus relative to domestic production. Lead and zinc would then be unquestionably within the processing trade category, and vigorous foreign investment would be undertaken to ensure a continued supply of raw material. (b) A shrinkage of the processing industries to keep pace with diminishing domestic production. This would mean that lead and zinc would shift into the deficiency trade category. Lead imports would be for consumption rather than processing, and investment would be unlikely to take place. Considering the drawback and smelting-in-bond provisions of the tariff acts, and the natural desire of the processing industries to maintain their present position, one can predict the strong likelihood of considerable foreign investment in lead and zinc in the future.

Tin, the fifth item, differs from the other four in that it is the only one which has always been a deficiency trade item. Although as a result of the war the United States now has a domestic tin-smelting "industry" consisting of a single plant, the capacity of this plant is capable of satisfying only a small portion of domestic demand. In view of the geography of world tin production there is small chance of an expansion of the domestic industry, for it would have to be based on ore imports from British Commonwealth or Indonesian sources, most of whose output traditionally has been kept in British and Dutch hands from mine to metal stages. With such an expansion as the only motivation sufficient to cause any significant foreign investment in tin production or processing, in its absence there is no likelihood of such investment.

The remaining 20 mineral commodities on the potential deficiency list fall within the deficiency trade category at present, and the preceding discussion has shown

that one cannot expect any general increase in investment activity in the foreign production or processing of these minerals. This does not deny the probability of isolated instances of investment, which have occurred in the past and will undoubtedly continue to occur in the future. But with the domestic demand for these commodities arising from industrial consumers rather than from processors, the integration motive to invest is sufficiently weakened to make investment unlikely in the face of circumstances which enlarge the risk. Such investment, therefore, will probably continue to be a minor portion of the total, since future expansion of supply is unlikely to occur to any significant degree except in the underdeveloped countries, where unexploited deposits exist.

This conclusion is drawn from the history of foreign investment in such previous deficiency items as antimony, asbestos, chromite, and mica. Where there were sources of these minerals in close proximity to the United States (i.e., where the risk was apt to be least) there was investment activity on the part of American nationals; but where the sources were remote, in regions of political instability, or were colonial areas, investment was minor or non-existent despite the fact that these were the world's (hence the United States') principal sources of supply.

The conclusion, therefore, is that despite the long-run decline in mineral self-sufficiency which faces the United States, the future will probably not see a great wave of American private foreign investment in the production and processing of the minerals in which a deficiency may develop. If such investment were to occur on a large scale it would represent a major change in the pattern of mineral investment and would in all probability be due to a permanent sense of strategic responsibility in domestic industry which was engendered by conditions during and since World War II. The realization by domestic mineral industries of the danger of being complacently reliant on either dwindling domestic sources of supply for which the substitution of foreign sources would be insufficient, or on existing foreign sources which may themselves become insufficient relative to demand would cause a discounting of risk factors to a greater degree, and a large amount of foreign investment would be the probable result. It is still too early, however, to say whether this has actually taken place.¹⁸

The significance of Point Four in this respect is thus a matter of encouraging and enabling the development of foreign mineral deposits which would otherwise not be accomplished. The discussion thus far has emphasized the United States point of view—that the continued normal growth and development of industry in this country could be unduly hampered by the failure of the world supply of a raw

¹⁸ The considerable foreign investment in such items as manganese which has recently occurred, and the current plans for overseas mining ventures by U. S. corporations (according to the International Development Advisory Board's Report it will be at the rate of \$120,000,000 a year) does not necessarily indicate that such a change has occurred. It is impossible to say yet how much of it is nonrecurrent and due to present conditions. Moreover, this increase is still small compared to the great increase in postwar oil investment, which would seem to indicate that there has been no fundamental change in the investment pattern despite the preoccupation with the strategic situation.

material or materials to keep pace with the expanding foreign demand of the United States. Equally important, however, is the interest the rest of the world has in such a situation. The impact of an ever-growing U. S. demand on the world market for a particular mineral raw material could result in undue price rises because of the size of that demand relative to world demand. Such a situation would of course be welcomed by the fortunate producing countries, but for the rest of the world, bidding against the U. S. behemoth in the world market might be impossible, since the superior productive efficiency of this country in many types of enterprise would enable American producers to pay a higher raw material price than foreign producers could afford. Such a situation would impose still another strain on the already sensitive structure of world trade.

One result of such a price rise would be to stimulate the development of other foreign deposits by domestic capital under the spur of unusually high profits.¹⁹ It is by no means certain, however, that the extra supply called forth by the higher price would be sufficient to meet the United States demand and so keep the price stable. The relative scarcity of local capital would preclude large-scale developments, while the admittedly low level of technology would make large-scale production improbable.

It is here that Point Four could make its greatest contribution in the mineral field. The adverse market effects of anticipated shifts of the United States demand from the domestic to the world market could be forestalled by the development of foreign deposits through Point Four aid. In terms of the present discussion it is immaterial whether such aid were to be given in the form of guarantees to American investors²⁰ or through the lending of technical assistance to locally financed projects. It would seem, though, that the latter is further removed from the "old imperialism" which President Truman rightly decries.

In summary, the "mineral argument" in favor of a Point Four program runs as follows: In order to avoid a dislocation of world markets which would be as distressing to the world at large as it would be to the United States, there should be an increase in the supply of those materials to offset the increased foreign demand of this country. Although there will undoubtedly be considerable American foreign investment in mineral industries in the future, as there has been in the past, it may not occur on a significant scale in the mineral commodities in which the greatest and most critical shortages will develop. This is indicated by an analysis of past investment activity, which demonstrates that the major portion of such investment has been in those commodities which have supplied an important processing industry in this country, not those in which domestic production has been insufficient. Nor will there likely be sufficient local investment in foreign mineral production, because of the lack of capital and technical knowledge in those countries

¹⁹ This assumes that United States private investment would not occur because of the absence of the integration motive, as explained above.

²⁰ Cf. the proposals made by the International Development Advisory Board (*op. cit.*, Chapter Eight).

where known discoveries await development or future discoveries are most likely to be made.

Point Four aid to foreign underdeveloped countries which fosters the development of their mineral resources is not a new argument in terms of promoting the general economic development of those countries. The significance of this aid in terms of the future world supply and demand of mineral raw materials, however, has been heretofore unappreciated. The United States would no longer be relying on the false and dangerous assumption that the need for foreign minerals leads to foreign investment in the production of those minerals. At the same time the rest of the world as well as this country would benefit from the stabilizing effects on world mineral prices of Point Four aid in mineral production.

THE ORIGIN OF THE IDEA OF NATURAL FRONTIERS IN FRANCE

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IT has been not uncommon for states that cast envious eyes on the lands of their neighbors to appeal to a higher law in justification of their claims. The idea of "natural frontiers" has at some time or in some way been employed politically by many nation-states and forms an interesting complement to the no less significant idea of "living space." Both ideas are in a sense an appeal to the higher sanction of a "natural law."

The recent publication of a critical edition of the *Testament* of Cardinal Richelieu¹ suggests a consideration of the doctrine often ascribed to him, of "*les limites naturelles*" of France. On the basis of this work and of a small number of other texts the French historian, Sorel,² built up an interpretation of French policy as one of steady advance towards the Rhine, the Alps, and the Pyrenees. "*La politique française*," he wrote, "*avait été dessinée par la géographie*."³ It has become fashionable in certain quarters during the present century to believe in the inevitability of a geographically controlled expansion. The doctrine ascribed to Richelieu so much resembles the modern idea of *Lebensraum* that its origins become worthy of particular consideration. The interpretation offered by Sorel was readily adopted by German historians, received the approval of the historian Ranke, and issued in innumerable pamphlets and brochures in which the infamy of French policy was attuned to the mind of every class of reader. Since then however, not only has Richelieu's authorship of the words so often ascribed to him been discredited,⁴ but the existence of such a *motif* in French policy has been disproved.⁵ On the other hand there can be no doubt that the idea of *limites naturelles* had gained a wide acceptance in literary and educated circles, and that it was of political importance at the time of the French Revolution.

THE MEDIEVAL FRONTIER OF FRANCE AND GERMANY

In 843 the Empire of Charlemagne was divided between his three grandsons (Fig. 1). The brothers met near Verdun. The chronicler Nithard, who appears to have been present, described the scene.⁶ Who, it was asked could form

¹ *Testament politique*, edited Louis Andrée (Paris, 1947).

² A. Sorel, *L'Europe et la révolution française* (Paris, 1897).

³ *ibid.*, I, p. 246.

⁴ L. Andrée, *op. cit.*, p. 66; W. Mommsen, *Richelieu, Elsass und Lothringen* (Berlin, 1922).

⁵ G. Zeller, "Histoire d'une idée fausse," *Revue de Synthèse* (Paris), XI (1936): 115-131; G. Zeller, "La Monarchie de l'ancienne régime et les frontières naturelles," *Revue d'Histoire Moderne* (Paris), VIII (1933): 305-333.

⁶ Nithard, *Monumenta Germaniae Historica*, Scriptores, II, p. 671.

a clear mental picture of the Frankish realm, or make a survey of it, so that it might be divided the more fairly. There was no such survey, and the brothers proceeded blindly to divide their father's realm. The frontiers which were thus laid down were not drawn with any precision. This *pagus* was assigned to Charles

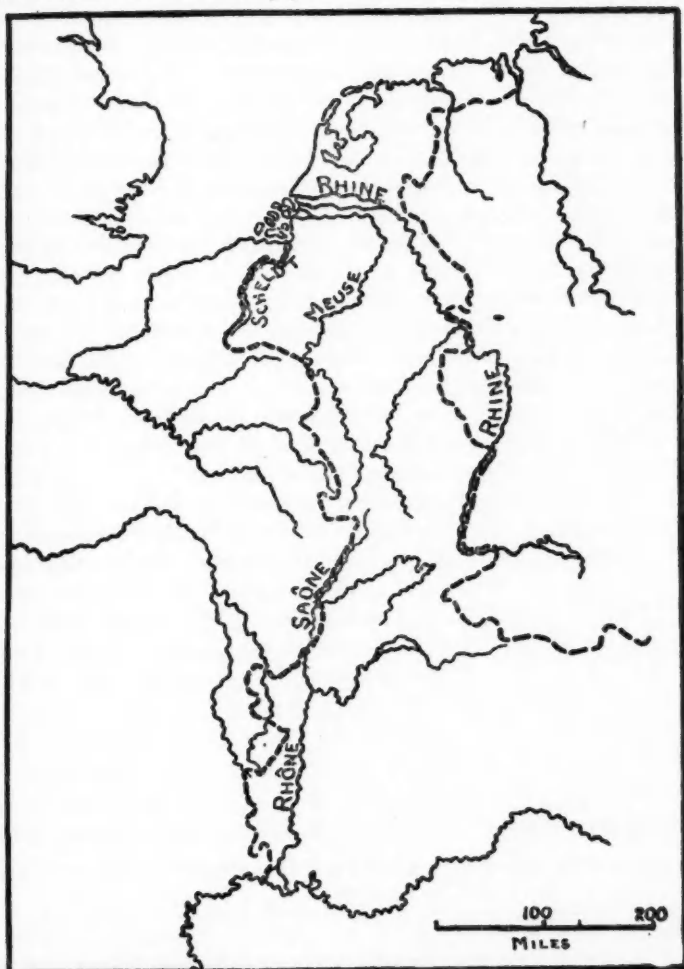


FIG. 1. The frontiers established by the Treaty of Verdun (843). The boundaries of the Middle Kingdom follow, though only very approximately, the valleys of the Rhine and of the Scheldt-Meuse-Saône-Rhône.

of France, that to Lothaire, another to Lewis Germany. The line between their respective territories was that which divided *pagus* from *pagus*, county from county. These latter units appear to have derived in large measure from the administrative

divisions of the Roman Empire.⁷ Each consisted of a capital with its surrounding and tributary territory. Each may have been separated from the next by the no-man's land of wood and marsh. The boundary was a belt rather than a line, a 'march,' without inhabitants or value, awaiting settlement and apportionment to one side or the other.⁸ The boundary established at Verdun between the kingdom of Charles (*Francia*) and that of Lothaire (*Lotharingia*) followed, if only very approximately, the valleys of the Scheldt, Meuse, Saône and Rhône, lying now to one side, now to the other of these rivers.⁹ Its course changed during the middle ages in response to influences. One was the gradual clearing and settlement of the waste land in which lay the frontier zone. Disputes arose between the communities on each side of the frontier for possession of resources of timber and game, and the growing number of disputes led to a greater precision in demarcating the frontier.¹⁰ Secondly, the popular mind refused to consider a frontier, approximating so closely to the line of the rivers, as being anything other than the rivers themselves. Already in the ninth century Regino of Prüm described Lotharingia as bounded by the Meuse and the Rhine.¹¹ This opinion came eventually to be widely held. The short distances which separated the Scheldt from the Meuse and the Meuse from the Saône presented few difficulties and occasioned no serious disputes. The boatmen on the lower Rhône still in the nineteenth century took passengers from "*le royaume*," or France, to "*l'empire*" and back. Leopold of Bebenburg, writing in the fourteenth century described the Treaty of Verdun as giving to the French king all to the west of the Meuse.¹² In the Debate of the Heralds (c.1450) the French herald boasts of the beauty of French rivers, of which, he remarks, the Saône separates Germany from France.¹³ At about the same time Gilles le Bouvier described the frontiers of France.¹⁴ They were marked, he wrote, by the Rhône and the Saône up as far as the borders of Lorraine. Near here rises the Meuse, which serves as a frontier until it reaches the province of Hainault. A day's journey hence is the source of the Scheldt, which forms the frontier as far as its union with the sea.

If further evidence were wanted that the Meuse was popularly regarded as the frontier of France, it can be found in the interesting anecdote told by Martin and Guillaume du Bellay. The Emperor Charles V, visiting Luxemburg in 1546, was passing along the eastern or imperial bank of the Meuse, when he noticed the

⁷ A. Longnon, *Atlas historique de la France* (Paris: 1884-1907); also, A. Longnon, *Géographie de la Gaule au VI^e siècle* (Paris: 1878).

⁸ R. Dion, *Les Frontières de la France* (Paris: 1947), p. 16.

⁹ A. Longnon, *Atlas*, Plates XI-XV.

¹⁰ Ch. Petit-Dutaillis, *The Feudal Monarchy in France and England* (London: 1936), p. 10.

¹¹ *Monumenta Germaniae Historica, Scriptores*, I, p. 568.

¹² *De iuribus regni et imperii Romani*.

¹³ *Le Débat des hérauts d'armes de France et d'Angleterre*, edited L. Pannier and P. Meyer (Paris: Société de Anciens Textes français, 1877), p. 47.

¹⁴ *Le Livre de la description des pays*, edited E. T. Hamy (Paris: Recueil des Voyages et des Documents pour servir à l'Histoire de la Géographie, 1908), 32.

newly built French fortress town of Villefranche (near Mouzon) on the opposite side. Du Bellay's account may be quoted.¹⁵ "When he had reached this place the Emperor complained to the ambassador of the French king, who happened to be with him, that the town had been built upon imperial territory. The records of the district, covering two centuries, were brought and examined, and it was shown that the inhabitants of the new town were subjects of the French king."

At the same time the more easterly frontier, separating Lotharingia from the German kingdom came to be equated with the river Rhine. This frontier was of less significance because early in the tenth century the middle kingdom was absorbed into Germany. Lotharingia retained, however, a certain individuality and was several times defined as lying between the Meuse and Rhine. These limits were described by Bartholomeus Anglicus¹⁶ in the mid-thirteenth century, by Leopold of Bebenburg¹⁷ in the fourteenth, and by Jordanus of Osnabrück at about the same time.¹⁸

In this way was fashioned a view of European history which regarded the continent as having been divided in 843 into three parts lying, respectively west of the Meuse, between the Meuse and the Rhine, and east of the Rhine. What happened in areas where these rivers could not possibly serve as frontiers was not considered. It was all a highly academic speculation. Already, however, the Germans had begun to justify the absorption of the middle kingdom by Germany.¹⁹ It was not long before the French were to question this right and to claim the middle kingdom as part of France. Long before the Middle Ages drew to a close we see the protagonists gradually taking their stand in a dispute, the issue of which was, in effect, which river, Meuse or Rhine, separates France from the Empire.

The nomenclature which medieval writers were obliged to adopt was confusing and sadly tarnished such little clarity of thought as they may have displayed. *Lotharingia* had clearly once been part of *Gallia*, or Roman Gaul; it was now absorbed into *Germania*. *Francia* was the kingdom of France, properly so-called, but *Lotharingia* was also known as *Francia orientalis*. The two *Franciae* might thus be equated with *Gallia*. It was more simple to translate *Gallia* by *Francia*. In 1114, Otto of Freising described the Emperor as crossing the Rhine from Germany into France.²⁰ Jordanus used the word *Gallia* to indicate the territory west of the Rhine. *Gallia large sumendo est Europe provincia, habens in oriente Rhenum,*

¹⁵ *Mémoires de Martin et Guillaume du Bellay*, ed. V. L. Bourrilly and F. Vindry (Paris: Société de l'histoire de France), IV, p. 325; also I, p. 137.

¹⁶ *De proprietatibus rerum*, English translation of John Trevisa, 1535, not paged.

¹⁷ *Op. cit.*, p. 14.

¹⁸ *Des Jordanus von Osnabrück Buch über das Römische Reich*, edited G. Waitz (Göttingen: 1868), p. 75; also W. Schraub, "Jordan von Osnabrück und Alexander von Roes," *Heidelberger Abhandlung* (Heidelberg), XXVI (1910).

¹⁹ See Jordanus, ed. Waitz, p. 68, and Leopold of Bebenburg, *passim*.

²⁰ *Monumenta Germaniae Historica, Scriptores*, XX, p. 359.

magnum fluvium.²¹ Brunetto Latini, writing about the mid-thirteenth century, shows how the change from *Gallia* to *Francia* took place. "*Après Alemaigne, outre le Rhin, est France, qui jadis fu apelée Gaule . . .*"²² At about the same time Bartholomeus Anglicus was writing: "*Francia . . . hath the Reine (Rhine) and Germain in the easte syde . . . throughe the borders of which land renne two most noble ryvers that is to wytte, Rodan (Rhône) and Rhene (Rhine) . . .*"²³ The change is complete. In the academic circles of monkish writers, with their little knowledge of the classical authors and even less of medieval history, the Rhine is already thought to be the frontier of France. Upon this issue a battle royal was to be fought by similar intellectuals a century or two later.

THE CHANGING CONCEPTION OF THE FRONTIER

As the middle ages drew to a close, however, there occurred a significant change in the nature of frontiers. The medieval writers and politicians have been taken to task by modern geographers for their blindness to geographical values in thus partitioning river basins whose economic and cultural unity they considered to be obvious. They think, however, in terms of the modern conception of frontiers. During the Middle Ages the institution of seigneurie and fief had obscured the earlier Roman conception of sovereignty.²⁴ Kingship was "a question of justice and lordship, not of sovereignty, and the arguments were of a feudal, not a national character . . . lordship and sovereignty have never been the same thing."²⁵ The nominal frontier failed to divide a German feudal hierarchy from a French. Instead, the feudal obligations interpenetrated.²⁶ "There were lords of the Empire who were vassals of other lords of the Empire for lands held within the Kingdom of France . . . and conversely, there were lords of France, vassals of the Emperor for lands held in the kingdom of France; for a century the Counts of Champagne were vassals of the Hohenstaufen for three of their French territories. From the time when Count Henry rendered homage for them to Frederick Barbarossa, the king of France had no feudal rights over them but he was still their king . . ."²⁷ The frontier between France and the Empire held little meaning, and it would have been a wise king or emperor who knew where it ran. There were times, however, when a greater precision was necessary, and then the king held an inquest. The reason was usually one of legal jurisdiction, of judgment and punishment. The local inhabitants were required to declare whose subjects they were.²⁸ Some,

²¹ *Op. cit.*, p. 54.

²² *Li Livres dou Tresor*, edited P. Chabaille (Paris: Collection de Documents inédits sur l'histoire de France: 1863), p. 167.

²³ *Op. cit.*, unpagéd.

²⁴ Ch. Petit-Dutaillis and P. Guinard, *L'Essor des états d'occident* (Paris: 1937), p. 233.

²⁵ Ch. Petit-Dutaillis, *The Feudal Monarchy in France and England* (London: 1936), p. 12.

²⁶ W. Kienast, *Die Deutsche Fürsten im Dienst der Westmächte bis zum Tode Philipps des Schönen von Frankreich* (Utrecht: 1924-31).

²⁷ Ch. Petit-Dutaillis, *loc. cit.*

²⁸ See particularly H. Stein and L. Le Grand, *La Frontière d'Argonne: Procès de Claude de la Vallée* (Paris: 1905).

untroubled by such enquiry, were able to maintain a quasi-independence even, in one exceptional case, to the time of the French Revolution.²⁹ Despite these exceptions, however, the later Middle Ages were characterized by a growing precision, as the frontiers were made to coincide more and more with the rivers. This development coincided with the growth of a conception of sovereignty that is more nearly modern. A feature of the sixteenth century was the new rôle assumed by the State, which began to focus the loyalty of its subjects, to command their obedience, and to legislate for their welfare. The multifarious duties, functions, and exactions of the modern state developed slowly, but already in the sixteenth century the frontier was beginning to assume a new function. The tenuous sovereignty of the Middle Ages began to take on some shape and form, but the older frontiers continued to be respected, and, however unsuitable they may have been for their new functions, acquired a deepening significance. Rivers had served the purpose of frontiers in the Middle Ages; they were made to serve in the modern.

That rivers are ill-suited, as a general rule, to become political frontiers has long been apparent. Fiefs lay astride the river frontier.³⁰ A town on one bank established a suburb on the other for the convenience of its trade.³¹ The existence of the frontier constituted no difficulty as long as its function was only juridic. In the modern view a national or state frontier serves to divide one sovereign territory from another; it separates groups of peoples with differing loyalties. The purpose of the medieval state frontier was not primarily to divide sovereignties. There was, in theory at least, only one sovereignty in Europe, that of the Emperor, which transcended the boundaries of kingdoms. The medieval state was a bundle of feudal rights and obligations. France was that territory within which the seigneurs owed homage for their lands to the king of France. Likewise the Empire, in the narrower and more generally accepted sense of that word, was the lands held of the King of Germany. An individual lord could, and often did hold lands of both the King of France and the King of Germany. The County of Bar, after the settlement of Bruges, was divided, the more westerly part, known as 'le Bar mouvant' being held of France, the more easterly of Germany (Fig. 2). The river Meuse separated the two allegiances. Examples of such fiefs, united in administration, divided in allegiance, were more numerous in the Low Countries, where the County of Flanders lay astride the Scheldt. A town lying on the one bank obtained, for the purposes of its trade, possession of the territory which lay opposite. Courtrai, Valenciennes, and Ghent thus came to span the frontier of France and Germany. There was no sense of conflict; the life of market and farm was one thing; the homage of the seigneur another.

²⁹ A. Brette, *Les Limites et les Divisions territoriales de la France en 1789* (Paris: 1897), p. 18.

³⁰ e.g. Bar. The part west of the Meuse was eventually separated as "le Bar Mouvant" and placed under French suzerainty; see M. Grosdidier de Matons, *Le Comté de Bar des Origines au Traité de Bruges, 950-1301* (Bar-le-Duc: 1922).

³¹ e.g. Valenciennes and Courtrai.

THE GROWTH OF NATIONALISM

While, within the sphere of practical politics, the accepted frontier was thus coming to be defined with ever greater precision, the academic speculations of the classroom were beginning to arouse doubts and ambitions in the minds of many

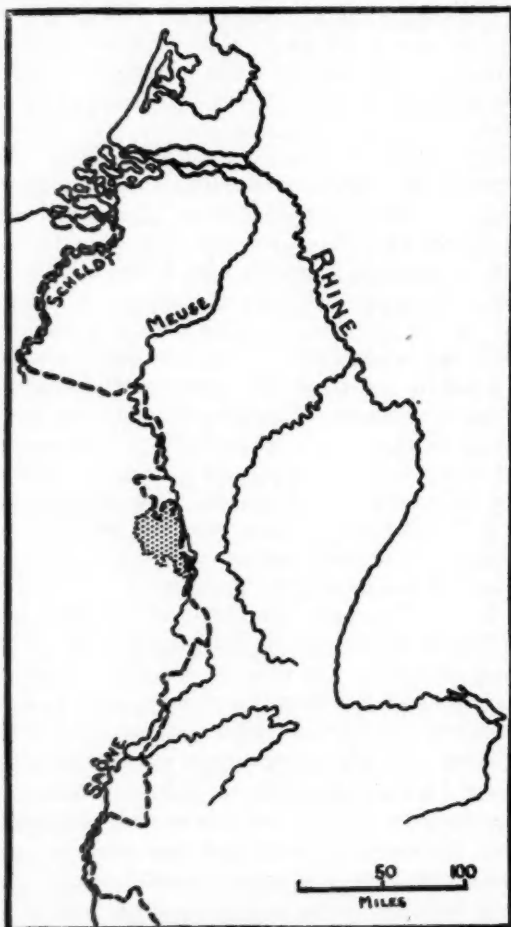


FIG. 2. The frontier between France and the Empire in the fourteenth Century. The shaded area denotes the "Bar Mouvant," an imperial fief, the suzerainty over which passed to France in 1301.

practical men of affairs. Prominent amongst these was Pierre Dubois, a hanger-on of the court of Philip the Fair of France and a member of the rising and

aspiring middle class. Like most of his class, he looked to the king to moderate the extremes of feudal license and he saw in a strong monarchy a protection for his own interests.³² He was prepared to see his royal master extend his frontiers to the Rhine, especially if such a step would increase the strength of the King relative to that of the feudal nobility.³³ In his tract on "*The Recovery of the Holy Land*," he urged the French king to absorb into France all the land west of the Rhine.³⁴ An anonymous manuscript in the Bibliothèque Nationale, possibly from the same hand, refers to the rumour then current that King Philip was then considering such a step.³⁵

Such questionings formed the background of what happened at Vaucouleurs in 1209. Vaucouleurs lay on the borders of Toul, and thus at the meeting place of France and Germany, a common meeting place for such discussions as that which followed.³⁶ A marriage treaty was signed between Philip the Fair and the Emperor Albert of Nassau, and the Meuse for part at least of its course was recognized as their mutual boundary. What else may have been considered we do not know, but from this conference there spread a crop of rumours which continued to echo and re-echo for the next four centuries.³⁷ William of Nangis claimed that the German Emperor had agreed to an advance of the French Kingdom to the Rhine.³⁸ The Chronicle of St. Denis³⁹ repeated the rumour, which was also taken up and retailed by Gilbert de Fracheto.⁴⁰ On the other hand, German chroniclers are silent upon such a concession and we may, with Boutaric,⁴¹ remain sceptical of its reality.

This claim was, however, to be repeated before the Middle Ages had drawn to a close, and, early in the sixteenth century, was to arouse the strongest opposition from the German humanists. In 1444, the Dauphin Louis, later Louis XI, captured Montbéliard, a possession of the Counts of Württemberg, and advanced to the Rhine. It was thought that he had come, wrote Aeneas Sylvius, to vindicate the French

³² See F. M. Powicke, "Pierre Dubois: a Medieval Radical," in *Historical Essays*, edited by T. F. Tout and J. Tait (Manchester: 1925).

³³ See H. Kampf, "Pierre Dubois und die geistigen Grundlagen des französischen Nationalbewusstseins um 1300," *Beiträge zur Kulturgeschichte des Mittelalters* (Leipzig), LIV (1935).

³⁴ "Totam terram citra Rinum Coloniensem," *De Recuperatione Terre Sancte*, edited Ch-V. Langlois (Paris: 1891), p. 104.

³⁵ Bibliothèque Nationale, 6222C. See Natalis de Wailly, "Mémoire sur une Opuscule anonyme intitulé Summaria brevis et compendiosa doctrina felicitis expeditionis et abbreviationis guerrarum ac litium regni Francorum," *Mémoires de l'Académie des inscriptions* (Paris), XVIII, ii (1849): 435-494.

³⁶ R. Dion, *op. cit.*, pp. 27-32.

³⁷ See E. Boutaric, *La France sous Philippe le Bel* (Paris: 1861), pp. 398-399; Abbé Clouet, *Histoire de Verdun et du Pays Verdunois* (Verdun: 1867), II, pp. 42-43; A. Leroux, *Recherches critiques sur les relations de la France avec l'Allemagne*, (Bibliothèque de l'Ecole des Hautes Etudes, Paris), L (1882).

³⁸ William of Nangis, *Historiens de France*, XX, p. 581.

³⁹ Chronique de Saint-Denis, *Historiens de France*, XX, p. 666.

⁴⁰ Gilbert de Fracheto, *Historiens de France*, XXI, pp. 17-18.

⁴¹ E. Boutaric, *op. cit.*, p. 398.

claim to the Rhine.⁴² But Aeneas Sylvius had no doubts upon the rights of this matter; Alsace had once been part of Gaul, he wrote,⁴³ but was not German. Sorel has enumerated several such anecdotes and sayings. At their least they are mere table-talk; at most, the expressions of informed but unofficial opinion. In this atmosphere of the fifteenth and sixteenth centuries a thoughtless remark could have serious consequences. The German Diet reproached the French King with having said on more than one occasion that he desired nothing more than to water his horse in the Rhine.⁴⁴ In the course of the sixteenth century the idea began to assume a more concrete form, but remained, nevertheless, the weapon of the pamphleteer and of the back-stairs politician. Jean le Bon claimed in 1563⁴⁵ that the Rhine might serve to protect France from her enemies and the same theme had been adopted a few years earlier⁴⁶ by Joannes Macer.⁴⁷ Gaspard de Saulx Tavannes went yet further in adducing a divine sanction for the Rhine frontier.⁴⁸ "It would seem that God has placed barriers which he did not wish to be easily crossed; to Spain, the Pyrenees and the sea; to France, the sea, the Pyrenees, the Rhine, and the Alps of Switzerland and Piedmont; to Italy, the sea and the Alps." Such then was the "manifest destiny" of the nation-states of western Europe.

THE GEOGRAPHICAL BASIS OF THE STATE

Such pretensions did not, however, pass unchallenged. The German humanists of the Rhineland were not content with questioning the historical validity of the French case, if such it may be called. They brought a counter argument the historical importance of which has scarcely been less, that of the linguistic or racial basis of the state. The medieval German writers, whose opinions have been considered already, were, when all is said, merely voicing their objections to a French emperor. They were not German patriots, least of all German nationalists, but a sense of nationhood is implicit in the writings of the humanists, Wimpheling, Murner, Beatus Rhenanus, and Irenicus.⁴⁹

In 1501 Jacob Wimpheling published his *Germania*, in which he set out to demonstrate that Alsace was German and that the French had no valid claim to the Rhine as a frontier. He was contradicted on certain academic points by Thomas

⁴² "Der Briefwechsel des Eneas Silvius Piccolomini," edited R. Wolkan, *Fontes rerum Austriacarum*, LXI (1909).

⁴³ Aeneas Sylvius, *Historia de Europa*, cap. XLIII.

⁴⁴ The source is a despatch of the Venetian Ambassador, quoted by M. Gachard, *Trois Années de l'histoire de Charles-Quint* (Brussels: 1865).

⁴⁵ *Le Rhin au Roy*, ed. A. Benoit, quoted G. Zeller, in *Revue d'Histoire Moderne*, VIII (1933), pp. 305-333.

⁴⁶ *De prosperis Gallorum*.

⁴⁷ Possibly a nom-de-plume of le Bon; see G. Zeller, "La Monarchie de l'ancien régime et les frontières naturelles," *Revue d'histoire moderne* (Paris), VIII (1933), pp. 305-333.

⁴⁸ *Mémoires*, quoted by A. Sorel, *op. cit.* I, p. 265.

⁴⁹ See A. Horowitz, "Nationale Geschichtschreibung im sechzehnten Jahrhundert," *Historische Zeitschrift*, XXV (1871): 66-101.

Murner, but on the main issue there was complete agreement.⁵⁰ Alsace was "German and not French"; it had been occupied by the Romans, but the subsequent invasions had thoroughly Germanised the area. Not only was the language of its people German; its place names were German rather than French and Wimpheling claimed that the area was lacking in French monuments and inscriptions.

Irenicus and Beatus Rhenanus emphasised yet more strongly the argument that language is the criterion of national and political obligation. In his *Germania Exegeseos*, Irenicus set out to study and describe the "language frontier."⁵¹ Beatus described the settlement of Germanic-speaking peoples west of the Rhine, where they changed not only the language *sed instituta quoque et cultum*.⁵² Conrad Peutinger wrote more briefly but to the same effect.⁵³ Resellianus took Tacitus to task for ever having described the Rhine as the frontier of Gaul, going on to demonstrate the extent of the German penetration of that territory.⁵⁴

It is interesting that the cartographers of the Renaissance invariably indicate the Rhine as a frontier. It is possible however, that this practice which, in the hands of the German cartographers, was so markedly at variance with that of their literary contemporaries, derived from a faithful representation of the geographical data of Ptolemy. Gaspard Trechsel prepared maps to illustrate Pirkheimer's Ptolemy; not only did it represent the Rhine as a frontier, but indicated in a marginal note that Germany was bounded by the Rhine, Danube, and Vistula.⁵⁵ Sebastian Munster similarly indicated that the Rhine was the boundary of Gallia and Germania. In 1538, Oronce Finé published his *Nova totius Galliae Descriptio*, indicating in his map that the Rhine, together with its most easterly distributary, the river now known as the Ijssel, formed the frontier of France.

In the cartography of the sixteenth century rivers received a prominence that was out of all proportion to their true importance in the landscape or in the lives of the people. Gaston Zeller has suggested that the doctrine of "natural frontiers," at least in so far as it applies to rivers, arose naturally from the popularity and use of such maps. It was, as he expressed it, "*filie de la cartographie*." It is not improbable that the concept of the Rhine as a great physical barrier to the movement of armies received considerable support from the printing of these maps, but the idea of the Rhine as a frontier of France is certainly older.

This controversy had in large measure spent its force by the end of the sixteenth century, though its echoes reverberated into the seventeenth. By the eighteenth century it was dead. It is not a little strange that it is to the seventeenth

⁵⁰ E. von Borries, *Wimpheling und Murner im Kampf um die altere Geschichte des Elsasses* (Heidelberg, 1926). Von Borries gives the text of Wimpheling and of Murner. See also *Germania von Jacob Wimpheling übersetzt und erläutert von Ernst Martin* (Strassburg, 1885). Charles Schmidt, *Histoire littéraire de l'Alsace* (Paris, 1879) gives a good summary.

⁵¹ *Germania Exegeseos*, Book X.

⁵² *De Rebus Germanicis*, Strasbourg edition of 1610, pp. 208-210.

⁵³ *De mirandis Germaniae* (Strasbourg, 1530).

⁵⁴ In *Corneli Taciti Equitatis Romani Germaniam Commentaria*, edition of 1610.

⁵⁵ *Europae Tabulae* (Vienna, 1551).

century, rather than to earlier ages that the French historians, such as Sorel, have looked for evidence to substantiate their thesis. The seventeenth century was a period when French foreign policy acquired a new vigour and when considerable territorial advances were made in the east. The chief authors of this policy, Richelieu, Mazarin, and Louis XIV, do not appear to have been inspired by any doctrinaire conceptions of the destiny of the French state. Their policy was empirical. Richelieu's purpose in the 1640's might almost be said to have been *not* to annex Alsace to the French crown. He most certainly did not propound that doctrine which equated France with Gaul and regarded the Rhine as the legitimate frontier of France.⁵⁶ We are left however with the possibility that some sort of doctrine of '*limites naturelles*' may still have been entertained perhaps by hangers-on about the court or by a group of the more politically conscious of the king's subjects. Amongst these were doubtless many whose schemes were more grandiose than those of the king and his ministers. Such a person was Jacques de Casson, who rejoiced at the prospect of the *fleur de lys* blossoming *again* on the banks of the Rhine.⁵⁷ The Sieur Aubery, not content with denouncing as a "usurpation" the occupation of Lotharingia by the German, Henry the Fowler, in the tenth century, also claimed for his royal master, as the successor of Charlemagne, the whole of Germany.⁵⁸ Aubery's views were extreme, and his master, whom he eulogised so highly, committed him to the Bastille for his pains. François Maynard, in an ode to the Cardinal Richelieu, looked forward to the time when the Rhine "*sera français des deux bords*."⁵⁹ At about this time the English traveler, Coryat, seems to have picked up similar ideas in the course of his journeys in Europe, and described the Rhine as the frontier between France and Germany.⁶⁰

From the German side the last blow appears to have been struck by Hermann Conring,⁶¹ who published in 1653 a treatise on the limits of the German Empire. He repudiated⁶² all French claims to the lands east of the line of the Meuse and the Rhone. With a wealth of learning, he defined the medieval frontier and traced the course of what he termed French aggressions. Above all, he cited the alleged French claim to "natural" limits, and refuted it with the argument drawn from language.

The controversy was now dead. Europe was passing into a more rational age,

⁵⁶ G. Zeller, "Histoire d'une idée fausse," *Revue de Synthèse* (Paris) XI (1936): 115-131, and M. Deloche, "Le Testament politique du Cardinal de Richelieu," *Revue Historique* (Paris), CLXV (1930): 43-76. Wilhelm Mommsen recognised in Richelieu, *Elsass und Lothringen* (Berlin: 1922) that Richelieu never committed himself to such a doctrine.

⁵⁷ *Le Recherche des Droicts du Roy et de la Couronne de France* (Paris, 1646), pp. 562-563.

⁵⁸ *Des Justes Pretentions du Roy sur l'Empire* (Paris: 1667), p. 85.

⁵⁹ François Maynard, *Ode à Monseigneur le Cardinal Duc de Richelieu*, *Oeuvres Complètes*.

⁶⁰ *Coryats Crudities*, edition of 1611, p. 441.

⁶¹ See E. von Moller, *Hermann Conring der Vorkämpfer des deutschen Reichs* (Hannover: 1915).

⁶² *Opus de Finibus Imperii Germanici*, edition of 1680, (Frankfurt).

with whose spirit such claims and counter claims were out of keeping. Voltaire and Montesquieu are both silent upon these issues which remained forgotten until used again to justify the aggressions of the French Revolutionary leaders. It is remarkable that until this latter date the doctrine does not seem to have appeared in a document of state or to have been expressed even unofficially by responsible French statesmen. It derived from the chatter of monkish historians; it was canvassed by members of the rising middle class and became the debating point of Renaissance scholars. Before the years of the French Revolution it was neither a conscious objective of French policy nor had it any serious influence on the statesmanship of France and of her neighbors. In large measure it had derived from historical studies and from the renewal of interest in classical writers. Those who wrote of France's destiny on the Rhine were in a sense reactionaries. No argument which may be described as geopolitical appeared before the sixteenth century, and even then its importance was slight. It was the Revolutionaries who, without so much as a backward glance at the history of France, talked glibly of her "destiny" on the Rhine.

ABSTRACTS OF PAPERS PRESENTED AT THE 47TH
ANNUAL MEETING OF THE ASSOCIATION, HELD
AT CHICAGO, ILLINOIS, MARCH 19, 20, 21, 22, 1951

LEWIS M. ALEXANDER—*A Survey of Commercial Rivalry between the North Sea Ports of Belgium and the Netherlands.*

One of the greatest problems facing western Europe today as it moves toward closer economic cooperation is that of the long-standing rivalry between certain industries within neighboring countries. As long as this bitter competition exists, international unity of any sort is extremely difficult. Such is the case of the North Sea ports of Belgium and the Netherlands where, in spite of the recent customs agreement, the historic struggle between them still shows little signs of abatement.

An intricate system of waterways serving eastern France, the Low Countries, and western Germany focuses on a small area along the North Sea where for centuries commercial cities have thrived on the trade passing from the hinterland to overseas areas. In recent times the twin cities of Rotterdam and Antwerp have emerged as the leading seaports of their respective countries. Much of the controversy between them has centered on the Rhine River traffic moving to and from the industrial areas of western Germany. Dutch control of the mouths of the Rhine, Meuse, and Scheldt rivers has given the Netherlands a decided advantage over Belgium, and for over three hundred years the Belgians have sought to remedy this situation by the construction of a direct Scheldt-Rhine canal, either across Dutch territory or through the hills south of the border.

Today relations between the ports have been further complicated by the marked decline in Rhine shipping, owing to economic conditions within western Germany, and by renewed Belgian demands for an Antwerp-Rhine canal. However, with the conclusion of the Benelux Customs Union embracing the two countries, some formula must eventually be worked out to bring economic peace to the Lowland ports.

HOMER ASCHMANN—*A Consumer-oriented Classification of the Products of Tropical Agriculture.*

Current efforts to achieve economic betterment for the underdeveloped tropical regions of the world probably must focus a major share of their attention upon increasing agricultural productivity. The tropical climates afford particular advantages for the growth of certain plants. Even if agricultural output per unit of labor can be increased, the problem of marketing the commodities will remain. The following classification of the products of tropical agriculture is proposed as an aid to understanding relations of particular commodities to world markets.

- I. Products of plants which grow only in the tropics and possess properties which cannot be duplicated or satisfactorily approximated in the mid-latitudes. A product can fall in this class only when a demand for it exists among consumers in the mid-latitudes.

- II. Products which compete with equivalents or substitutes produced in the mid-latitudes. The tropical product can enter mid-latitude markets because it can be produced more cheaply and/or possesses advantageous qualitative characteristics compensating for heavier transportation expenses.
- III. Tropical products which do not now enter mid-latitude markets. They may be consumed locally or sold elsewhere in the tropics.

While a given commodity may shift its position between these categories due to technological developments or the introduction of new competing plants, each category has distinctive characteristics which permit useful generalizations to be drawn concerning the marketability of its component crops. On this basis it is hoped that this classification will be of value to those concerned with improving economic conditions in the tropical areas of the world and to economic geographers seeking a framework in which to describe tropical agriculture.

TRACY B. AUGUR—*Regional-Urban Relationships: Desirable Future Patterns.*

Regions as discussed here are those in the United States in which there is a clear dominance of the occupations and economic activities generally associated with cities—in other words, regions whose primary function is to service the urban activities within them rather than regions whose cities are merely service centers for agricultural or other extensive regional pursuits.

Within this category, two general types are recognized (1) the metropolitan type which is related to a major central city, like the New York region or the Chicago region, and (2) the type which is related to a group or cluster of cities no one of which holds a clearly dominant place in the regional economy. Sections of the North Carolina piedmont or parts of Connecticut or upstate New York illustrate this second type.

A desirable future pattern for such a region is one which best enables it to perform its function in the national economy. The function is to facilitate the urban life and urban type occupations that are carried on within them or which should be carried on there for the nation's benefit.

This is not the same as saying that their function is to facilitate the life of their towns and cities because some of the activities that are broadly classed as urban may be conducted outside of cities in rural surroundings. This may be true even more in the future than it has been in the past.

Most urban regions took their form before the advent of modern transportation and communication facilities, and before we had had any experience with extremely large cities.

Desirable future patterns should take into account the opportunities for better living inherent in the new facilities together with the social, economic and strategic disadvantages or excessive concentrations.

GEORGE BEISHLAG—*What Cartography Can Do for Geography Students.*

The increasing *respectability* of cartography will be followed by increased enrollments in cartography classes. Cartography majors and geography students do not

need the same type of training. What cartographers teach the geography students may determine the future relations between cartography and geography. Exaggerated emphasis on hand lettering and constructing map grids may make geographers consider cartography primarily manual work.

The geography student should be taught how to use maps and how to make maps. Suggested teaching topics are projections, prime meridians, scales, the value of a map, publishing authorities, dates of issue, age, special uses, and place names.

Topics in mapmaking might include selecting a base map, compiling, choosing background data, color, or pattern, selecting lettering and widths of line, and plotting data. Maps should be traced from base maps and lettered with guides or printed type.

Adoption of some such program will be to the mutual advantage of cartography and geography.

JOHN E. BRUSH—*The Trade Centers of Southwest Wisconsin: Factors Governing the Size and Location of Agricultural Trade Centers.*

Analysis of the size and functional variations among agricultural trade centers in southwest Wisconsin shows that there is a graduated succession of functions among them. A threefold classification—hamlets, villages, and towns—is apparent when the centers are grouped according to the completeness of the assemblage of functions found in them.

The geographic distribution of hamlets is governed mainly by a radial principle of location, while the distribution of towns and villages is influenced by a linear principle as well as by a radial principle.

WESLEY CALEF—*The Utility of the Benefit-Cost Ratio.*

The benefit-cost ratio is being used with increasing frequency in the investigation and analysis of projects and programs of resource development. However, the proponents of the ratio have advocated its use for purposes for which it is wholly inadequate. There are very sharp limitations on the justifiable utilization of the ratio, some theoretical, others practical.

The benefit-cost ratio cannot justify or fail to justify a resource-development project or program because such a conclusion demands the illogical exclusion from further consideration of all factors, however relevant and pertinent, which do not lend themselves to fairly precise monetary expression.

The benefit-cost ratio cannot furnish automatic justification for even limited monetary aspects of a project or program because of inherent limitation on the calculations of the benefits and costs. These limitations have been ignored by making false assumptions as to the nature of benefits and costs. Despite the fact that the nature of the unjustified assumption has been repeatedly pointed out, the error still persists widely.

The benefit-cost ratio is shown to retain a high degree of utility when used legitimately. It would be as illogical to analyze a project or program without making use of the types of information which the benefit-cost ratio is best equipped

to furnish as it is to exclude items from consideration because they cannot be fitted into the formula.

LUCILE CARLSON—*The Mining District of Kiruna Stad, Sweden.*

The Kiruna mining district is a part of the great Lappland iron-ore reserve of northern Sweden. The deposits are located, in the main, in three mountains that lie just outside the town: Luossavaara, Kirunavaara, and Tullavaara. The Kiruna ore beds spread over a distance of 7 kilometers, with an average width of 100 meters and beyond proven depths of over 500 meters.

Some of the richest ore deposits in the world, they contain between 60 and 70 per cent pure magnetite. But they are also high in phosphorus, which ranges from 0.02 per cent in the richest ores to 3 and even 4 per cent and above in the poorer types. For this reason, most of the ore is exported, the domestic iron and steel industry preferring the low-phosphorus but relatively high-sulphur ores of the central region.

Though situated well above the Arctic Circle, the location of Kiruna is relatively favorable as far as transportation is concerned. A railroad connects it with the ice-free port of Narvik, Norway (170 kilometers distant), and Luleå, Swedish port on the Baltic. Nearly 90 per cent of the ore goes out through Narvik.

The Kiruna mines are owned by Luossavaara-Kirunavaara Aktiebolag, of which half of the shares are held by the private concern, Trafik Grangesberg-Oxelösund; the other half are held by the Swedish government, which holds the right to purchase the shares of T.G.O. sometime in the future.

Though most of the mining is still done by surface methods, it is expected that within a 10- or 20-year period these will have been entirely replaced by underground methods. Preparations for this undersurface mining have already been begun.

RAYMOND E. CRIST—*Fixed Physical Boundaries and Dynamic Cultural Frontiers: a Contrast in the Department of Cauca, Columbia.*

At elevations of eight and ten thousand feet on the west flank of the Central Cordillera in southwestern Columbia, Indian communities practice intensive agriculture, whereas at the same elevations on the eastern flank of the Western Cordillera the dominant activity is cattle grazing. The Popayan peneplain, averaging some six thousand feet above sea level and lying between the Western and Central cordilleras, is ideal for intensive agriculture over much of its extent. However, in this fertile sector, grazing lands have tended gradually to expand at the expense of land devoted to growing crops. One would expect intensive agriculture to expand into areas of varying edaphic and climatic conditions, but instead it is cattle grazing that pushes across fixed physical boundaries and even encroaches upon land that is close to a market and physically ideal for intensive farming. The social and economic influences of the great landed estate seem to have outweighed the physical factors in the evolution of the present cultural landscape. The patterns of the cultural environment are set in the molds of the manorial system of landholding imposed on

the New World by the Conquistadores. As long as the *status quo* in social organization is maintained, the use of land on an extensive basis by a landed aristocracy will continue to give prestige and will be the socially accepted way of life.

ROBERT E. DICKINSON—*Terrain Types in Western Germany.*

A classification of the geographic landscapes of western Germany is based upon consideration of four sets of criteria: relief, soil, vegetation, and cultivated land, each divided into a number of categories and mapped on the scale of 1:250,000. On this basis about twenty terrain types are recognized and mapped throughout western Germany on the scale of 1:100,000. The terrain types are summarized below.

On the basis of the completed map series it was evident that the same kind of terrain appears in widely separated sections of the country and that contiguous terrain types fell into groups so as to form major physiographic units.

- 1a. *Alluvial Plain.* River valleys. Liable to flood. Heavy clay or loam. Damp woodland with alder and poplar. Meadow.
- 1b. *Alluvial Plain.* Clays or heavy loams above flood level, though water table near surface. Oak-hornbeam. Arable and/or meadow.
- 1c. *Marsh or Polder.* Flat, at or below sea level. Dyked and drained. Heavy clay or loam. No woods, mainly meadow. Drainage ditches. Linear settlement along roads and canals, or isolated settlements on raised hills (*Wurten*).
2. *Undulating or Flat Land.* Clay or loam. Grass and/or arable. Oak-hornbeam in NW, beech in NE, spruce in Bavarian Plateau.
- 2a. *Undulating or Hilly.* Shallow lakes. Heavy loam. Beech or pine woods in NE, spruce in S. Arable with hedged fields and woods.
3. *Low Plateau of Sand and Gravel (Geest).* Oak-birch woods, with heather and bracken on acid soils. Cultivated with patches of heath, bog, and wood. Open fields on heath, ditches on bog. Isolated farmsteads or open clusters of farmsteads.
- 3a. *Low Plateau of Sand and Gravel.* Dominantly heath and bog with patches of cultivation. Mainly fen (*Flachmoor*, "sedge swamp") or bog (*Hochmoor*).
- 3b. *Low Plateau of Sand and Gravel.* Reclaimed fen and bog with peat cuttings, land cultivated with canals and ditches. Linear settlements. Ecologically the same as 3a and due to reclamation.
4. *Low Plateau of Sand and Gravel.* Dry. Forested.
5. *Undulating or Flat. Loess-Loam Soils and Dominantly Arable.* Hedgeless fields, compact villages with no dispersed farmsteads. Oak-hornbeam in NW. Drier and warmer on loess in central Germany. Steppe-heath flora in drier warm areas of the Rhine Rift, valleys of the Central Uplands, and middle Elbe Basin.
6. *Undulating Land on Horizontal Limestones or Marls.* Thin loamsoil. Dominantly arable (up to 70% of total area), frequent patches of beech wood. Oak-hornbeam on drier and warmer soils. Compact villages.
- 6a. *Hilly Land on Horizontal Limestones.* Mainly cultivated. Frequent wooded hills. Regular average slopes of 5–10 degrees. Rich beech woods.

- 6aF. *Undulating or Hilly Land on Limestone*. Wooded plateaus. Steep-sided monoclinical ridges in the Weserbergland.
7. *Undulating Lowland on Heavy Clays*. Streams and lakes. Beech woods on acid soils with scanty ground flora. Over half arable but some hedged fields and pastures. Small villages and isolated farmsteads, e.g., Keuper Lowland and Woenvre in Lorraine.
8. *Rhine Plateau: Undulating: Open*. Beech forest, on wet, acid soils. Loam often on limestone or patches of loess. Over 70% cultivated (arable and meadow) with some wood, e.g. NE-SW strips in the Eifel on limestone outcrops, Condroz in Belgium, Westerwald basalt plateau, and the Bergisches Land.
9. *Rhine Plateau. Low Altitude (250-400.500 meters)*. Undulating, with deep steep-sided valleys. Forested clearings, much coppice scrub. Thin clay soil. Beech forest on acid soils.
10. *Rhine Plateau. Low Altitude (250-400.500 meters)*. Occasional deep gorges. Dominantly forested (beech), or bog on acid soils, e.g. Hautes Fagnes and Hohe Venn.
- 10a. *As 10*. Deeply dissected with forest and bog and heath, e.g. Hohe Eifel and Siegerland.
11. *Plateau on horizontal sandstones with deep, steep-sided valleys*. Acid soils, Dominantly forested; few clearings, e.g. Hardt, Odenwald and Spessart.
12. *Urban Terrain*. Outline of urban areas with over 100,000 people. Circles for urban areas with less than 100,000.

FRANCIS E. ELLIOTT—*Physical Types and Regional Pattern of the Marine Surface Waters of the Earth*.

Maull's "Grenzguertelmethode" has been applied to define the types and regional pattern of marine surface waters. Surface temperatures, annual variation of these temperatures, surfaced salinities, major surface currents, belts of prevailing winds, Koeppen climatic types, and average limits of sea ice have been used as criteria. Two major influences on these types can be recognized: latitudinal influence and continental influence. The major breakdown is oceanic waters and continental waters. The individual types and their geographic locations are described.

JOSEPH FISHER—*Regional-Urban Relationships: From the Viewpoint of the Region*.

In these times of uncertainty and danger, economic and social effectiveness are greatly needed. In part this means effective relationships among major geographical divisions of the country, including urban centers and larger regions. From the point of view of the region a blending of these three elements of development is required: regional growth, regional stability, and regional security. Standards for each of these are to be found in local, in regional, and increasingly in national terms. The principal factors in regional development such as natural and human resources, technological change, and national policies are the materials from which regional growth, stability, and security are constructed. Policies and actions for regional development must be worked out in concert with those aiming toward urban development since the two are interdependent. The requirements for regional growth,

stability, and security have special meaning for effective regional-urban relationships; and include such matters as the contribution of cities to the achievement of regional development potentials, economic and social stability of cities as condition for regional stability, and the emerging problems of dispersion and decentralization.

EARL PARKER HANSON—*Revaluation of the Problem of White Men in the Tropics.*

Two years of critical examination of the literature on adaptation to the humid tropics show only one characteristic consistently throughout that literature: inconclusiveness and disagreement mounting toward chaos. In general, there is no knowledge on the subject; there are only clashing opinions, culturally determined. This literature shows the futility of seeking explanations through simple relations of cause and effect in a field in which all effects stem from the complex *interactions* of multiple causes.

Since results to date indicate that the wrong methods of investigation have been followed, it may be well for geographers to tackle the problem through the concept of regionalism, applied to various parts of the tropics. Under this concept, any one region is a living integrated whole and is dealt with as such instead of being divided into its various inseparable components.

J. FRASER HART—*The Effect of the Forestry Commission on the Geography of Britain.*

The Forestry Commission, a semiautonomous branch of the British Government, was established in 1919 to ensure the afforestation of 1,777,000 acres so that Britain might be less dependent upon imported wood and wood products. In 1943 the goal of the Commission was raised to 5,000,000 acres of effectively managed woodland. Friction with agricultural interests led to its being made responsible to the Minister of Agriculture for England and Wales and to the Secretary of State for Scotland in 1946, so that its work could be more closely integrated with theirs.

The Commission has been forced to acquire land on the open market. Instead of attempting the reforestation of cutover areas, it has preferred to acquire new land for afforestation. This policy has been the result of its desire to hold large blocks of land which could be managed efficiently rather than to attempt to cope with many small scattered woodlands, and is open to criticism in land-poor Britain, despite its economic advantages.

The holdings of the Commission in 1948 included large forests in the Brecklands, the Cheviot Hills, the New Forest, and the Forest of Dean, with many smaller plantations scattered throughout Britain. It holds large potentially forestable acreages in the uplands of Wales and Scotland, but it faces the problem of having to acquire increasingly larger acreages of land on which economic afforestation is impracticable. Thirty-eight per cent of its holdings had been planted in 1948, and 24 per cent were considered potentially plantable, but 550,000 acres, or 38 per cent of its lands, were unfit for afforestation.

The land best suited for afforestation has already been acquired, so new acquisitions will probably contain large unplantable acreages. In attempting to achieve

its goal of 5,000,000 acres of effective woodland, the Commission may well have to acquire from 8,000,000 to 10,000,000 acres of Britain, or almost one-fifth of the entire island. The planting of 3,000,000 acres of new woodland will work a startling change on the face of Britain, as will the concentration of control over so large a part of the island in the hands of one government commission.

LESLIE HEWES AND PHILLIP E. FRANDSON—*Occupying the Wet Prairie: The Role of Artificial Drainage in Story County, Iowa.*

The drainage of wet land is a factor in human geography which has received slight attention. This paper is intended to throw some light on the matter by giving detailed attention to a small but representative part of the wet prairie region of the Middle West.

For Story County, in central Iowa, the soil survey and other evidence indicates that fully one-third of the county was poorly drained prairie at the time of early white settlement. Drainage, now nearly complete, began in the 1880's but went on especially rapidly between 1910 and 1920, when most of the county drainage enterprises were undertaken. Most of the larger wet areas were drained by a combination of county and individual effort; commonly, the smaller areas were drained earlier and without use of county organization. In the county today, roughly 60 per cent of the area is classed as artificially drained and approximately 40 per cent of the county is included in county drainage enterprises.

Poorly drained upland constituted an important natural limitation on the early development of the county in (1) some retardation of settlement, (2) the high incidence of malaria during the pioneer period, (3) difficulty of transportation during the early decades, and (4) important disadvantages in land utilization.

As late as 1880, wet land constituted a considerable disadvantage to settlement. The disadvantage might have been greater but for two considerations: (1) most land areas of the size of the average farm included some well-drained land, (2) settlers already familiar with the problems of poorly drained land pioneered in several of the wettest townships in the county. Norwegians, with some help from Danish settlers, played especially important roles. These considerations help to account for the fact that by 1885, even before much artificial drainage had been done, settlement was nearly complete, with more farms than now and five-sixths as much land in farms as now, although with notably less land cropped. Malaria and meandering roads were no longer characteristic by 1900.

Poor drainage handicapped land utilization since the land that could be cultivated was limited and commonly in patches. The presence of wild hay discouraged the growing of tame hay and the development of systematic rotation of crops. With the nearly complete elimination of wet land from the upland has come a large measure of uniformity in land use and land values throughout the county.

G. ANGUS HILLS—*Integrated Soil-Climatic Units for Local and Regional Evaluation of the Cropping Capabilities of Land.*

In order to compare, locally and regionally, the capability of land to produce

plants, both in quality and yield and in species and variety, a simple basic classification of the total environment (site) is needed. The mere superimposition of climatic isopleths on soil zones is seldom adequate. Soil zones reflect merely the characteristics of the areally dominant soils, and the so-called regional climate is usually based on inadequate sampling of local climates. The basic classification must therefore be a framework of on-the-spot integration of soil and climate to which vegetative cover and other land-use features may be related in an organized way. These well-integrated complexes of soil and climatic features are but the basic portion of the all-inclusive environmental complex (land in its totality).

Though the features which constitute the environmental complex (site) are so interdependent that the effect of any one factor on another cannot be predicted until the entire complex is known, it is possible to group all sites into classes based on the sequence of single features or simple complexes of closely integrated features. The levels or intensities of each feature chosen are arranged in sequence from one extreme to the other, and the entire range is divided into eleven divisions at points which appear to have significance in a general use-capability classification. Between the two extremes, normals are established qualitatively by definition (rather than quantitatively by averages weighted by area of distribution) in order to provide definite reference levels within the scale. The concept of a comprehensive highly integrated environmental complex makes possible a subdivision based on different environmental factors at different levels of classification. Great site groups based upon climatic sequence are broken into site classes based on geomorphic sequence and these again into natural or cultural sites based on sequences of vegetative succession, human occupancy, and other features.

Most on-the-spot integrations must be made without the use of elaborate soil and meteorological equipment. The primary qualitative definition of these "reference sites" is not in terms of local soil and climate but rather in terms of geomorphology. However, they are given simple soil-climatic handles for convenience in showing interregional relationships of soils and vegetation. Different soil and vegetation types will characterize the same geomorphic type in different climates and constitute the basis for regional differentiation.

The stable geomorphic features which have been chosen to indicate significant controls of soil development within relatively broad limits of regional climate and mineralogical maturity are: (1) permeability of the geologic material, indicating the facilities for the movement and retention of underground water; and (2) underground water, integrating permeability and slope of surface and underlying impermeable layers, and indicating the fluctuations in the levels of moisture actually available to plants (soil moisture regime).

The chief geomorphic features which control local climate are: (1) relative mass elevation, (2) aspect, and (3) proximity to bodies of water.

An outline of the application of this site classification to land in Ontario is presented.

GEORGE W. HOFFMAN—*The Dutch-German Boundary: a Postwar Problem in Political Geography.*

Of the many problems in political geography which arose at the end of World War II, the Dutch claims for numerous changes along their boundary with Germany received little attention. The boundary changes demanded by the Netherlands Government form only one of several demands; others include indemnification for the losses and damages sustained in the economic sphere.

The demands by the Netherlands Government for certain boundary corrections can be traced to the damages caused during the war by the Germans. These demands were guided by the following principles: (1) shortening of the frontier lines, (2) improvement of local communications, (3) local improvement of canal- and waterworks, (4) social and economic improvements, and (5) redress of local anomalies. It was hoped that the border would be shortened from 525 to 340 kilometers, which would call for the transfer of 119,000 people.

Due to the general political situation in Europe and the postponement of a final treaty with Germany, only small corrections were considered by the western powers. In March 1949 nineteen rectifications, totaling 487 acres with 9,553 people, were transferred to Netherlands administration, pending the final conclusion of a peace treaty with Germany. These corrections extend from the Westerwoldsche A in the north to Vaals (west of Aachen) in the south of the Dutch-German boundary. Most of these corrections were of minor character: little land and few or no people were involved, with the two exceptions of an area east of Sittard, and Eten, north-east of Emmerich on the Rhine.

Using the official report of the Demarcation Commission, a series of detailed maps, aerial photos, personal observations at various points along the border, studies of German scholars, and comments supplied by the United States, Dutch, and German governments, I have tried to classify the nineteen corrections approved by the Demarcation Commission according to their main characteristics:

- A. River improvements, two;
- B. Reclamation schemes, three;
- C. Customs anomalies, twelve;
- D. Communication improvements, two;
- E. Economic changes, two (same as D).

Four representative corrections are being used as case studies; they are: (1) Westerwoldsche A, (2) Dinkel River, (3) Dinxperlo, and (4) Sittard-Selfkant.

Everyone agreed that the gains by the Dutch were minor. The question is then raised whether or not such border corrections were worth-while, considering the western powers' attitude regarding recognition of the changes on Germany's eastern border. Much opposition, even among the Dutch, was expressed. The writer concludes that such border corrections could easily have been settled to the mutual satisfaction of both countries. Overcoming rather than changing long-established dividing lines is the only solution for people and their countries in this century.

ROBERT C. KLOVE—*The Definition of Standard Metropolitan Areas.*

Standard metropolitan areas have been defined for 172 metropolitan centers in the United States and its territories and possessions by a Federal committee under the direction of the United States Bureau of the Budget. Each of the new standard metropolitan areas consists of one or more entire counties and contains at least one city with a population of 50,000 or more. An exception is made in New England, where the areas are defined in terms of towns. The general concept adopted is one of an integrated economic unit with a large volume of daily travel and communication between the central city and the outlying parts of the area. Certain definite rules have been followed in applying this general concept to the definition of individual areas. A Census Bureau technical subcommittee helped set up the criteria and prepare tentative definitions which were discussed with local groups in each area by representatives of the Bureau of the Budget.

The problems encountered in defining the metropolitan areas are discussed under four headings:

The determination of the criteria.—The need for defining the areas in terms of counties for most of the United States and by towns in New England is explained.

The application of the criteria.—The definition problems of peripheral counties, "split" counties, and competing cities are pointed out with illustrations.

Outside pressure for exceptions to the criteria.—Pressure from local groups for changing metropolitan area definitions has developed for various reasons. Some wish to see their area as large as possible. Others seek statistics for a special area of their own definition. Still others want to include only parts of counties or favor the old metropolitan district. Some close-by cities want to be separated; others wish to be combined.

The data available.—Census statistics were basic in applying the criteria. Data supporting the economic and social integration of counties came from State employment security agencies, traffic and commuting studies, urbanized area patterns, and telephone toll call information.

FRED KNIFFEN—*The Range-Cattle Complex: Preliminary Notes.*

The range-cattle complex is conditioning or has conditioned the occupancy pattern over much of Anglo-America lying west of the ninety-eighth meridian and between the Mexican boundary and the northern limit of the Great Plains.

Within the ranch area there is a dichotomy of practices traceable to one of two nuclear areas, south Texas and southern California. The former was influenced by both Spanish-American and old English-American traditions, while California evidenced little alteration from the Spanish prototype. Texas influenced in the main the range country east of the Rockies, while the western section drew principally from California.

Illustrative of the details of the complex recoverable only through the memory of old cattlemen is the spinner used to make hair ropes. Apparently device and products were retained in California-influenced sections but were abandoned by Texans.

A thorough knowledge of the range-cattle complex is regarded as an essential prelude to the full geographical treatment of the area involved.

A. W. KÜCHLER—*The Relation between Classifying and Mapping Vegetation.*

Vegetation maps are increasingly in demand but their character is not always well understood, even by many of the authors, and the resulting classifications are therefore often inadequate. The relations between mapping and classifying are discussed, and the purpose of the map is found to play an important part in this relationship. The basis of all classifications used on vegetation maps is relatively narrow, yet most authors pay little attention to existing classifications and thus retard the introduction of much-needed standardization.

Criteria to evaluate vegetation maps are proposed, especially with regard to terminology, reliability, and the character of classifications. In the end, a vegetation map is found to be a composite representation of an author's systematic classification and Nature's kaleidoscopic arrangement of plants. The unity and clearness of the composite depend on the skill and insight of the mapper.

JOHN S. KYSER—*Terrebonne Parish, Louisiana: a Subdelta of the Mississippi.*

Terrebonne Parish, Louisiana, is a Mississippi River delta parish with variant features of both the natural and cultural landscapes. In nature, it displays an instability of surface that is linked up with distributary action, other surface geomorphic processes, and the dynamism of an active geosyncline. In the realm of culture, the region presents an extraordinary intermixture of cultural behavior groups and types of landscapes. The succession and supplementation of economic landscapes presents a broad façade of confrontation of the old and the new. Relict features are numerous in both the natural and the cultural landscape. The region exhibits a dualism and presents an opportunity for choices and decisions for the future that are a challenge to the development of a wise symbiosis.

DAVID W. LANTIS—*Rural Land Use in the San Luis Valley, Colorado.*

The San Luis Valley forms the major agricultural subregion within the Southern Rocky Mountains. Despite certain physical limitations in this well-defined intermontane basin, there are 750,000 acres under irrigation agriculture today. The location of irrigated land has been largely determined by the availability of water; elsewhere in this near-arid basin the land is used as a low-capacity livestock range.

The outstanding subdivision of the Valley is the Sargent-Center district, which presents the finest agrarian landscape within the eight Mountain States. Its prosperity is based upon the production of quality Red McClure potatoes, which are sold throughout the central United States. In sharp contrast to this district is the contiguous Alamosa Borderlands, which contains some of the area's poorest farm lands. Even here, however, Japanese farmers are reclaiming the once-seeped Waverly community. The little Del Norte-South Fork district, with head lettuce, potatoes, and small herds of beef cattle, has physical advantages lacking elsewhere in the Valley.

Irrigation agriculture is significant in each of the basins of principal tributaries of the Rio Grande. In the Conejos Basin, the "Mormon Country" is significant. Here the Mormons have modified farming practices of the Salt Lake Oasis to fit the environment. In the upper Culebra Basin, the subsistence plot of the Spanish-American persists despite disrupting influences.

Large cattle and sheep ranches prevail over the three-fourths of the Valley not devoted to irrigation agriculture. Considerable livestock improvement has occurred, but the limited amount of mountain pasture for summer grazing will prohibit the expansion of the livestock industry.

GRAHAM H. LAWTON—*Changes in the Distribution of Population in Australia between the Two Census Years 1933 and 1947.*

The pattern of the distribution of the population of Australia has shown certain definite characteristics from the earliest days of European settlement. There has always been an abnormal concentration of population in the capital cities. Between the census years of 1933 and 1947 the total population increased 14.34 per cent, from 6.62 million to 7.58 million. More than two-thirds of this increase of nearly one million persons occurred in the two states, New South Wales and Victoria, which together accounted for more than 68 per cent of the total population of Australia. In 1933 these two states accounted for 63.3 per cent. The percentage of the total population in the six state capitals rose from 46.98 per cent to 50.9 per cent. In Victoria and South Australia more than 59 per cent of the population of each state lived in the capital cities of Melbourne and Adelaide.

The percentage of population in the rural divisions of Australia declined from 37.35 per cent in 1921 to 35.91 per cent in 1933 to 31.06 per cent in 1947. Compared with the intercensal period 1921-33 when there were percentage increases in the rural population in all six states (40.98 per cent increase in Western Australia and 23.84 per cent increase in Queensland), in five of the six states there were losses of rural population for the intercensal period 1933-47. New South Wales was the only state to show a gain in the rural population for this period and this gain was only 4.47 per cent. Percentage losses of rural population in South Australia were as high as 8.74 per cent and in Victoria 5.67 per cent. Queensland showed the smallest loss of rural population, 0.34 per cent, the greatest percentage increase in both metropolitan and provincial urban population, more than 30 per cent in each case, and the greatest overall percentage increase of all the states, 16.75 per cent compared with the 14.34 per cent for the whole country.

Some of the reasons for the decrease in the rural population have been the tremendous development of secondary industry in the metropolitan areas during and since the war years, the increased opportunities for employment in the provincial towns, the introduction of machinery on the farms, the abandonment of some of the marginal farm lands in southeastern Australia, and the improved facilities for communication and transport. The coastal urban concentrations will become an even more marked feature of the population pattern in future years.

HOWARD H. MARTIN—*Twenty Years of the Hudson Bay Route.*

To provide a short cut from the Canadian prairies to northwest Europe, the 510-mile Hudson Bay Railway reached tide-water in 1929. Inside well-protected headlands at the mouth of Churchill River a modern grain and freight terminal was built, with an elevator holding $2\frac{1}{2}$ million bushels and grain galleries with berthing space

where three freighters can load at the same time. Laid over muskeg, much of the railway roadbed was unstable; Hudson Strait presented navigational difficulties; and the ice-free shipping season was short.

Two pioneer freighters took out 544,000 bushels of wheat in 1931; the movement increased to fifteen ships and 4,293,500 bushels in 1936 but there followed a gradual decline. During World War II the Bay Route to Europe was not used, although the building of an American airbase at Churchill (1942-43) provided considerable traffic for the railway.

At the end of the war the wheat lift was resumed, and shipments have increased each year. With the sailing of the SS "Italterra" on October 4 the 1950 season closed; 20 vessels and an export of 6,767,743 bushels set a new record.

Wheat exported through Churchill originates in central Saskatchewan, only a few cars coming from Alberta or Manitoba. The area where Churchill can compete in rates with the Lakehead-Montreal route grows some of the highest-protein wheat in Canada. The railing of grain up the so-called Muskeg Line begins in June, although the first vessels cannot get through the field ice in Hudson Strait until early August. A new record was set in 1950 when two freighters reached the elevator on July 31. The recognized season is now about nine weeks.

Primarily a wheat route, the Bay Line also handled some general inbound freight for cities such as Saskatoon and Regina; three vessels carried British manufactures in 1950, including cement, glass, steel products, automobiles, refrigerators, and hardware. Growing sources of revenue are black spruce pulpwood, fish from northern Manitoba lakes, supplies for mining camps, and general haulage for the joint Canadian-American base at Fort Churchill.

Churchill harbor has a minimum of silting; it was dredged to a 30-foot depth in 1939, and no further dredging was done until 1950. The river is free of ice during the shipping season. In spite of fogs, field ice, and an occasional iceberg, vessels with radar screens now navigate Hudson Strait with ease and safety. No freighter has been lost since 1936; insurance rates were lowered in 1949 and again in 1950. After 20 years of annual reballasting and driving of steel, the railway is now approaching stability, operating with less difficulty each year.

Measured solely in terms of wheat handled, men employed, or revenue earned, the Hudson Bay route cannot compare with the St. Lawrence. It plays an active and efficient role, however, in Canadian foreign trade, internal development, and national defense.

ALEXANDER MELAMID—*The Location of Modern Petroleum Refineries.*

In 1925 four basic types of petroleum refinery locations were being distinguished: (1) oil-pool, (2) oil-field, (3) market, and (4) seaboard export.

Owing to the greater efficiency of modern large-scale refineries, plants in oil-pool locations which usually operate on a very small scale have practically ceased to exist in industrialized countries. Further, the increasing consumption of fuel oil has in general reduced the advantages of oil-field and seaboard export locations and has

added to the attraction of market locations of refineries, as can be seen from the expansion of refining capacities on the United States Atlantic seaboard, in Europe, and in the LaPlata region of South America.

However, this trend towards market locations is not exclusive, and field and sea-board refineries are surviving and continuing to expand, relying on more efficient means of product distribution as well as on supplying regions without refineries or with permanent or seasonal deficiencies of refining capacity.

A fifth type of refinery location, not classified before, so-called politically intermediary locations placed between the territories of the producer and the consumer, may now possibly disappear owing to political pressure. Examples are the Dutch West Indies and Haifa refineries. Plants in such locations may continue to operate if their local markets warrant such activity.

ALFRED H. MEYER—*Circulation and Settlement Patterns of the Calumet Region of Northwest Indiana and Northeast Illinois: the Second or Pioneer Stage of Occupance, 1830-50.*

A cartographic representation and chorographic analysis of the occupance patterns of circulation and settlement of a region, as they have changed from one period to the next, are essential in understanding how the present-day landscapes have evolved out of the past.

This paper is the second of four companion studies of such sequent occupance through four stages of regional development as exhibited in the Calumet region of northwest Indiana and northeast Illinois. It deals with the period of the pioneer and is the sequel to the paper on the Pottawatomie stage of occupance, presented last year before the society.

The important relationships of land and life of the Calumet pioneer are considered in terms of the significance of location of the region, the recognizable areal correlations between the human and physical elements of the environment, the intra-regional and interregional relationships of the circulation and settlement patterns, and the interperiod relationships between the pioneer and the antecedent Pottawatomie forms of occupance.

The material is treated under the following headings:

- I. General objectives of the study
- II. Factors retarding circulation and settlement
- III. Factors promoting temporary and permanent settlement
 - A. Characteristics of the settlement pattern
- IV. Self-sufficient and subsistent type of frontier economy
- V. Rurban and urban settlements
 - A. Difficulties in defining urban pioneer communities
 - B. Factors conducive to nucleated settlements
 - C. The Indian village-pioneer town
 - D. Urban sites as related to natural elements
 1. The grove village
 2. The stream town

- 3. The lake-port city
 - E. The county seat center
 - F. The "dream city"
- VI. Pioneer industrial geography
- VII. Pioneer commercial geography
 - A. Fur-trading posts
 - B. Urban trade centers
- VIII. Travel and transportation problems resulting from poor drainage
 - A. Handicaps to circulation posed by the extensive marshes
 - B. Improvements in transportation facilities presage a new period of regional development, the next to be considered

Six maps are designed to exhibit the following physical and cultural patterns of the region: (1) landform-geomorphology, (2) relief-elevation, (3) drainage features and natural vegetation of the fundament, (4) original land, water, and timber survey transect, (5) sawmills and gristmills, and (6) Indian trails-pioneer roads and first settlements.

To facilitate orientation and comparison, the natural and pioneer landmarks have been superimposed on a specially prepared political base map of the modern period.

Scores of direct quotations from early local county and regional sources are used in the longer paper to add color and psychologic pioneer perspective.

E. WILLARD MILLER—*Agricultural Developments in the Fairbanks Region of Alaska.*

In recent decades there have been many attempts to extend agricultural pursuits into subarctic areas. One of the most important of these experiments is now occurring in Alaska. Interest in developing Alaskan farming began with the discovery of gold about 1900 when large quantities of food were needed by miners. In 1935 the Matanuska colony was established in southern Alaska, and in the last 15 years most of the writing has centered on this region. However, there are other potential agricultural areas, and in the Fairbanks region of the Tanana Valley an agricultural settlement has been thriving for nearly fifty years. It is, thus, the purpose of this paper to investigate the agricultural developments of the northernmost farming region in America.

Vegetables were the first plants cultivated in interior Alaska and remain today the most important crop. Essentially all hardy vegetables, such as potatoes, cabbage, carrots, beets, radishes, and lettuce, are grown. However, the vegetable farmer encounters many environmental and economic problems: short growing season, permafrost causing cool soils, unreliableness of production, shortage of labor, high cost of irrigation, destructiveness of rabbits, and marketing problems. Besides vegetables, hardy grains and grasses have also been produced for nearly fifty years. Livestock raising has proved successful, as demonstrated by three dairy herds in the region today.

The Farm Belt of Fairbanks is an established agricultural region. As a result of experimentation at the United States Agricultural Experiment Station and by individual farmers during the past fifty years, a variety of crops has been developed

which are adapted to subarctic conditions. While progress is still slow, the basic work is now being done for an expanded agricultural region as the population of interior Alaska increases.

NATHAN H. MORRIS—*Chicago Frontier: A Plan for the City.*

Chicago's situation near the head of Lake Michigan is a major geographic factor in its rapid growth into one of the great cities of the world. But as a residential site for three and one-half million persons, Chicago has scarcely begun to utilize the vast resources of its shore position along the lake.

The superb amenities of lake-shore living can be feasibly obtained for most or all Chicagoans in greater abundance than now enjoyed by the limited few living near the lake. Chicago has acquired riparian rights and built a renowned park system out of land reclaimed from the lake along most of its shore length. The lake is no deeper than 35 feet for two or three miles from the Chicago shore. From this shore, Chicago can build a series of peninsulas or promontories, each to house a planned community of some 50,000 persons. This would provide a desirable new direction of city growth. The flow to the suburbs would be retarded, and a base would be furnished for the hundreds of thousands of new apartments needed in the next generation. Residential land would become cheaper within the existing areas of the city, and the slums and other areas that wore out could be replaced by a garden city type of development to house all who want private homes plus the convenience of close-in location.

The promontories would not impair the view from the present shore, but would rather provide dramatic accent. The shoreline would be increased in length and could be developed for recreational use.

LOUIS C. PELTIER—*Tropical Geomorphology in Mindanao.*

A section of the Moro Gulf coast of Mindanao is taken as a sample area whose geomorphology is representative of the products of the selva cycle. It is dominated by a humid tropical (Af) climate. The land is built up of relatively young basaltic lavas and of Pleistocene valley fill deposits of coarse gravel, sand and silt. Coral reefs, similar to those which now fringe the headlands, also occur in terrace deposits. Rain forest vegetation dominates the clayey soils of the basaltic hills; tall grasses (cogon) prevail over the alluvial surfaces and lower hillslopes. Some of this grassland is a response to burning; some may reflect the high permeability of the soils.

Erosional processes reflect to a greater degree than in temperate regions the deep development of soils, the protective effect of forests, and the erosional effect of sub-surface waters. The effects of mass movement and spring sapping are clearly shown. Gullying and slopewash are chiefly reflected on the recently deforested clayey soils. Here accelerated erosion has produced boulder-strewn slopes and small block fields. These processes produce a lowering of hilltops and a broadening of crests toward a general accordance. Thus downwastage must be considered, together with lateral planation, in the interpretation of erosion surfaces.

Five stages in the geomorphic history are recognized. They are represented by

partial peneplains cut upon rock or terraces built of alluvium. The older ones are severely modified by downwastage. Along the major streams nickpoints developed during earlier stages are still retreating, with the enlargement of the downstream erosion surface, while the same surface is, further downstream, being destroyed by the retreat of a still younger nickpoint. Thus these geomorphic surfaces are not everywhere of precisely the same age.

NORMAN J. G. POUNDS—*The Concentration of the Steel Industry in Northwest Germany.*

In 1939 the steel industry of northwestern Germany was concentrated in a small area of the industrial Ruhr. At the same time ownership and control were vested in only six large concerns. This pattern—both geographical and economic—was achieved during the previous century.

In 1800 the smelting and steelmaking industries were spread over the hill country to the south of the Ruhr coal field. The introduction of the puddling process, which used coal, in the 1820's attracted the steelmaking industry towards the coal field, where there were at this time only a few small furnaces, which used charcoal to smelt the local bog iron ore. The steel industry continued to be important to the south.

About 1950 the coal measures iron ore began to be smelted and furnaces were erected on the coal field, though many of them continued to use charcoal. Then the introduction in 1849 of smelting with coke gave a new value to the coal field. Furnaces and steelworks began to be erected on the coal field in locations convenient for the import of foreign ores. Vales were thus reversed, and the steel industry grew from about 1870 on the basis of local coal and imported ore.

Canals were built to facilitate this import. Some of the old furnaces built to use bog or coral measures ore were closed down. The industry was gradually concentrated on the coal field along the navigable waterways.

At the same time ownership narrowed, as the economies arising from the merging or interlocking of concerns became apparent. Allied policy since 1945 has been to break up this narrow control. The success of this policy has not been complete and may not be possible while the steel industry remains concentrated within so small an area.

EDWARD T. PRICE—*Mixed-Blood Populations of Eastern United States.*

The socially distinct triracial mixed bloods are examined in terms of their distribution, general characteristics, and possible origins.

MERLE PRUNTY, JR.—*Water or Cotton: Dilemma on the Texas Llanos.*

Demand and prices for raw cotton today are at the highest levels since the post-Civil War decade. The 1950 cotton crop was abnormally small and this, plus the current military emergency, has created critical shortages of raw cotton. The backbone of the cotton industry is the short-staple cottons which do not compete to any

important degree with synthetic fibers. Immediate production increases are needed. The Texas Llanos is the leading American source-region for such cottons.

Three conditions are essential for *immediate* production increases: (1) mechanization (to permit rapid expansion), (2) sufficient additional available cropland adapted for row-crop cultivation unincumbered by investments in other forms of land use, (3) reliability of yields, particularly as guaranteed by irrigation. All three conditions apply on the Texas Llanos to a greater degree than in other major cotton regions. Production on the Llanos in 1951 will be double the 1950 output.

The Llanos faces a major water supply problem. 15,000 shallow wells have been drilled, mostly since 1938, to irrigate row crops. Producing horizons have dropped about 20 feet in the past 5 years and only about 30 feet of utilizeable water remains in the aquifer. There are no controls on drilling or application of well water. Although the exceptional current demand will result in huge production expansions on the Llanos, additional production will occur at the expense of the water supply.

The 1951 cotton crop poses a dilemma for the region. Should accelerated pumping continue, the region is threatened with loss of an economic cornerstone and the textile industry with loss of a key supply source for short-staple cottons. On the other hand, both national need and the economic returns from cotton in 1951 will be great. The region must establish a balance between available water supply and extraction rates in short order, but there is no indication that this will be achieved in the near future. Instead the current outlook is for more irrigation, more cotton, and, shortly, exhaustion of the Llanos aquifer.

H. F. RAUP—*The Northernmost Spanish Frontier in California as Evidenced by the Distribution of Geographic Names.*

Within the bounds of the State of California several widely divergent cultures have come in contact with each other. Of these, the two having the most pronounced influence on the present culture are the Spanish-Mexican and the English-American. One tangible evidence of this culture conflict or contact is apparent in the present-day distribution of Spanish and English geographical names within the state. Since California was first investigated by sea and by the Spaniards, the most ancient geographical names are of Spanish origin and are located at the more prominent points along the coast. Later during their land explorations the Spaniards also added many names to California's map. Following the Gold Rush, Americans retained many of the Spanish names and added others of English origin. The zone of contact between the cultures therefore is marked on the map as the weak northern frontier zone that formed the northern limit of Spanish-Mexican settlements, and the evidence of this zone appears in the intermingling of Spanish and English geographical names, with a limit beyond which Spanish names are not used in any large numbers.

ARTHUR H. ROBINSON—*The Value of Interrupting Map Projections in Point of View of Angular Distortions.*

During the past several decades interrupted or recentered projections having a continuous equator with lobate extensions on either side have become common. Rather extensive claims have been made as to the merits of these modifications, and the question as to exactly what was gained by interrupting a projection has been investigated. Some facts that came to light in the course of research on angular deformation provide a partial answer.

The procedure and its development from the work of Tissot and Behrmann were presented at these meetings last year. The procedure consists essentially of four steps: (1) outlining the land areas of major interest (Antarctica is excluded), (2) plotting the values and drawing the lines of equal angular deformation, (3) measuring with a planimeter the land area enclosed by succeeding isolines, and (4) deriving the mean angular deformation for the land in the manner of a normal hypsographic curve by finding the mean height of the deformation/land-area curve. The Sinusoidal, Eckert IV, Mollweide, and three new oval equal-area projections by Wereniskiold have been analyzed.

The mean deformation after interruption is significantly less than before. There seems to be some indication that interruption cannot reduce the mean deformation much below 18 degrees, unless a land mass is violated or different projections are joined. The percentage reduction of deformation averages out to about 36 per cent.

KIRK H. STONE—*Populating Alaska: Russian and English Settlement.*

Generalizations from research on Russian and English occupancy of Alaska are contrary to many popular beliefs. Actually it appears that Alaska may have been known to some people for much longer than its 200-odd years of recorded history. The settlement was a product of the curiosity of Russian Czar Peter the Great, explorer Bering, and administrator Baranof and of the opposing interests of the great Russian American Fur Company and the Hudson's Bay Company.

Continuing but varied Russian interests were responsible for relatively large numbers of Russians being in Alaska, nearly until the sale of the area to the United States in 1867. In the meantime, English settlement was specialized and localized at three places but was sufficiently strong to leave permanent effects.

Russian settlement is divisible into four periods: (1) pre-1741, the period of possible early discovery and legendary settlement, (2) the 1741-84 time of temporary settlement accompanying unorganized Russian fur hunting, (3) 1784-1830, the years of settlement on the southern and southeastern coast of the mainland in conjunction with organized Russian fur trade, and (4) the 1830-67 period of Russian settlement in western and southern Alaska, varying Russian interests, and the short-lived English fur-trading settlements in southeastern Alaska and the interior.

JOHN H. THOMPSON—*The Humboldt Route.*

The Humboldt River Valley, situated in the Great Basin of Intermontane Amer-

ica, is one of the outstanding communication arteries of the western United States. It served as an overland route for early emigrants and carried most of the traffic during the California gold rush of 1849. Later it became the route of two railroads, a principal highway, and transcontinental telephone and telegraph lines. It is followed even by air traffic.

Early wagon-train traffic to California followed the Humboldt Valley across the northern Great Basin because it provided a nearly level avenue through the mountainous terrain and supplied the indispensable articles of water, grass, and wood which were scarce in this dry region. Furthermore, it was favorably situated between South Pass, the major crossing of the continental divide at that time, and the rich mining areas to the west.

The choice of the Humboldt Valley as a route for railroads, a highway, and an airline was based largely upon the terrain advantages it possessed and upon its favorable position along roughly a straight line between the traffic-generating areas around Salt Lake City and San Francisco Bay.

After certain communication facilities were once established along the route and towns had sprung up, other communication facilities such as the telephone and telegraph advantageously associated themselves with the route rather than locate in the inaccessible and little-developed areas to either side.

There seem to be, then, at least three reasons why the Humboldt Valley has maintained such prominence throughout the various stages in the technical development of communication. First, it is situated roughly along a line which has been coincident with traffic demand. Second, the physical nature of the valley was much more favorable to communication development than the surrounding country. Third, early communication facilities in the valley and the economic developments associated with them attracted subsequent installations.

GLENN T. TREWARTHA—*Cities of China.*

As a result of compiling a list of the larger cities (50,000 population and over) of China and of constructing maps showing their functions, location, and distribution, important deviations from the Occidental pattern of urban development have been noted. Less than half of China's major cities are served by railroads. One metropolis of a million population has no rail connection. Only about half of China's cities are located on navigable waters and many of these are dubiously navigable by Western standards. An almost negligible number have noteworthy industrial functions. The problem which is posed, therefore, is concerned with what maintains and prospers the 200 or so modern Chinese cities.

Unfortunately the present paper is unable to give an adequate answer to the above question. Only through field study will the problem be solved. Some light may be thrown upon it, however, by an analysis of the origin and functions of Chinese cities of the past.

Most cities of ancient China appear to have been established in connection with an official residence. Their original functions were primarily political and military. The administrative walled city, together with its tributary agricultural area, com-

prised the essential political, economic, and social unit of ancient China. Supplementary urban functions, closely integrated with administration, were those of craft industry and trade, chiefly supported by the large and wealthy bureaucracy. Probably in no other country has political influence in city development operated so strongly and so continuously through the centuries as it has in China. Only in the last century has the Chinese concept of a city as the seat of a public official been significantly modified.

EDWARD L. ULLMAN AND WALTER ISARD—*Toward a More Analytical Economic Geography: the Study of Flow Phenomena.*

The scope of economic geography should be extended to embrace the study of flow phenomena, heretofore neglected in both economics and geography. The effective study of flow phenomena requires a new method of analysis which necessitates some of the concepts and techniques of both sciences.

The concept of a distance input, i.e., the movement of a unit weight over a unit distance, is proposed. In terms of it, the flows of raw materials and finished product in each economic activity can be expressed. But other spatial concepts, too, must be developed in order to understand the volume, intensity, and length of industrial and agricultural bonds which connect points in space, which interrelate regions, and which cause the sequence and existing pattern of human occupancy in diverse areas to be interdependent.

Adequate flow data are hard to obtain but can be used to provide greater understanding. As examples of the use of flow data, several maps have been prepared. The first shows rail shipments from Washington and Connecticut, two states unlike in location and industrial character but alike in size of labor forces. Washington's volume, particularly outbound, is much greater, reflecting its raw-material character; Washington likewise ships enormously longer distances, reflecting distance from market in contrast to Connecticut's location in the northeast. Both states, however, show a striking concentration of shipments to nearby points, reflecting the friction of distance. The second map shows flow of coal from West Virginia over half the nation, taking advantage of volume rail and water facilities, return hauls and absence of competition in certain distant areas. The third indicates the support of a port city, Mobile, in terms of origin and destination of all shipments. On land, hauls are relatively short; on the ocean, long, because of the nature of ocean shipping. Other examples have also been prepared.

One measure of the importance of flow is based on the United States census of industry, which indicates at least 16 per cent of the labor force employed directly in transportation and communication operation, transportation equipment manufacture, trade, and related service. At least another 14 per cent should be added: those employed in producing food, equipment, and services for the primary transport and communication workers. In reality, about 30 per cent of the labor force are employed in flow phenomena.

In spite of these numbers, average distances moved, especially over land, are short; the friction of distance is apparent and influential in the location of activities.

STEPHEN S. VISHER—*An Aspect of the Social Geography of Indiana.*

The distribution of the birthplaces of persons born in Indiana who have been sketched in *American Men of Science* and/or *Who's Who in America* does not correspond at all closely with the distribution of population at about their birth dates. Comparisons of the yield of notables per unit of population are made with distributions of (1) climatic types, topography, quality of land, and stage of development; (2) country, town, and city; and (3) chief occupational groups. The evidence indicates that the production or yield of leaders reflects selective influences rather than direct geographic environmental influences.

GUIDO G. WEIGEND—*German Ocean Shipping and German Recovery.*

The central location of Germany in the European continent has favored her development as a maritime nation. By exploiting her position and her resources fully, by 1939 the German merchant marine had advanced to fifth place in the world and German shipyards had reached second place in world ship construction. About 80 per cent of its ships had been constructed since World War I, giving Germany the youngest fleet next to that of Holland. In the years before World War II about two-thirds of all flagships in German ports were German. British ships were then second in tonnage. After 1939 German ships were replaced in importance by Swedish and Danish shipping, which had served principally on European shipping lanes.

Of the German ports, Hamburg was and still is by far the outstanding one in tonnage of goods handled. The Hamburg and Bremen port areas together, moreover, had more ships and companies than all other German ports combined and handled the bulk of the overseas traffic. Shipping services were world-wide, as were the operations of some companies, such as the Hamburg-American Line. Others were specialized in certain areas, as for example the West Indies. These services earned Germany about 10 per cent of her gross foreign exchange requirements.

At the outset of World War II Germany lost that portion of her merchant marine which was in foreign waters at that time. Temporarily the shipping situation seemed favorable when merchant ships of other countries were captured, but eventually the war cut deeply into merchant marine operations. The total losses of Germany as a result of the war and postwar actions were more than $4\frac{1}{2}$ million gross tons. In 1948 Germany was operating three-tenths of one per cent of the world merchant fleet, in 1949 six-tenths of one per cent, and in 1950 close to one per cent. Recovery for western Germany was much slower than for Japan and Italy because of the reluctance of other European maritime nations to admit Germany again to international competition, although the United States has maintained an opposite view.

West Germany's vessels have an average age of 40 to 45 years, and they are limited to 7,200 gross tons and 12 knots speed. Their cruising radius is no longer restricted, but the slow speed makes competition in liner (scheduled fast-freight)

service impossible. An even more pressing problem is the lack of capital in shipping circles, which reduces possibilities of improvement and expansion of the merchant fleet, even if permission is granted by the Allied occupation authorities.

With an increased overseas export-import trade, the German economy could well use ships to carry at least one-half of her ocean trade volume. She could save thus some of the foreign currency which she now has to pay to other maritime nations for carrying charges. Germany has the industrial and traffic potential for the creation and operation of her own shipping services. If political considerations make this impossible, general recovery of the economy will be seriously retarded.

JAMES R. WRAY—*The Reproduction of Cartographic Materials by the Stencil Duplicating (Mimeograph) Process.*

The stencil duplicating process has long been widely used for the reproduction of office textual materials. The technical advances of recent years merit new appraisal of its present usefulness in terms of our particular map reproduction needs. Modern stencil duplication is well suited to the reproduction of cartographic materials in quantity and with quality, in black-and-white and in color, speedily and economically. To achieve good results with the process it is not necessary to have elaborate equipment or to depend upon services outside one's own organization.

This paper describes the stencil duplicating process, shows examples of stencil duplicated maps, outlines very briefly how each of four variations is achieved, and suggests some of the applications of this form of map reproduction to geographic and cartographic work.

WILBUR ZELINSKY—*The Inversion of Georgia's Areal Population Pattern, 1850-1950: an Exploration of Techniques for Estimating Intrastate Migration.*

The rapid rise of Georgia's Inner Coastal Plain around the turn of the century from the most sparsely populated area in the state to one of its major demographic regions furnishes an outstanding example of inversion of pattern on the population map of the eastern United States within recent times. A full explanation of the phenomenon is lacking, but the possibility that the out-of-the-way position of this relatively productive region in respect to routes of early migration is responsible for delay in settlement is offered as a working hypothesis. In order to clarify the sources and nature of migration into the region, the only Census tables published on state of birth for inhabitants of counties, those of 1870 and 1880, are analyzed. Thornthwaite's and Lathrop's formula for estimating net migration has been elaborated into a set of equations distinguishing migration by the Georgia-born from that of those born elsewhere. The resulting maps reveal strong influxes of settlers in the 1870's into both the Piedmont and Inner Coastal Plain with net out-migrations in most other sections. The migrational movements of the Georgia-born display a strong awareness of the relative agricultural advantages of Georgia's regions. This fact prompts the suggestion that the superior selectivity of short-range migrants may prove to be a general law of migration.

REVIEWS AND ABSTRACTS OF STUDIES

RURAL NEW ENGLAND

John D. Black: *The Rural Economy of New England—A Regional Study*. xxiv and 796 pp. Cambridge, Massachusetts: Harvard University Press, 1950.

John D. Black, professor of economics in Harvard University, presents a regional study of New England which not only stands as a major contribution to the understanding of this part of the United States, but also marks an important advance in theory and practice of regional study as such. It is especially to the latter aspect of the book that the reviewer wishes to direct attention.

The opening sentence of chapter one leaves no doubt as to the basic objectives of the study. It is "to analyze the rural economy of New England in a way which will serve as a guide to its future." This objective, faithfully used to distinguish the relevant from the irrelevant, gives the work a tightness or organization not uncommonly lacking in regional studies which are aimed more broadly. It demonstrates the principles that in works of this sort there must be some central theme, a definite focus of interest, around which the regional phenomena are grouped. It also demonstrates the wide range of phenomena which can be attached to such a central theme.

Regional studies to be more than superficially descriptive take time. No one can become an effective regional specialist after a year or so of study—not even in our own country where there is no barrier of language or of cultural tradition between the observer and the things to be observed. Black started work on New England in 1929, and by 1941 had essentially completed the job. War conditions, however, delayed publication, and additional data were analyzed from the censuses of 1940 and 1945 to bring the study up to date. The work represents, then, some fifteen or more years of specialized attention to different aspects of a limited portion of the earth. Among other things, this period of time permits the observer to see the area over a span of years, and to develop his receptivity to the many intangibles, to the many things not reduced or reducible to census data, which are so important in any penetrating regional analysis.

The central focus of a regional study, as in

this case, lies presumably within the systematic field which the observer, because of his special training and experience, can treat with competence. But the regional analysis cannot stop there. The various processes of change, ranging from physical to cultural, all operate in accordance with their own laws or principles, yet each is somewhat modified because it goes on in the presence of all the others. How, then, can a student trained in one or more systematic fields, give expert handling to the data outside of the range of his experience? He does so by continuing his own training, extending his study to fields which are relevant to the problems of his area—and this, also, requires time. Black's chapter on the soils is an example. An economist, trained in the analysis of statistical data, is at first puzzled about how soils information can be used in studies of land use. His discussion of soil classification, their history, the uses, and of the things they cannot be used for, is a masterful job in a highly complex field, and one which most geographers could read with profit.

The book starts with a chapter entitled "The Assignment," in which the author defines his objectives and his limits. He presents eleven "factors of change" which he says are "reasonably sure" to be of major importance in understanding what is taking place in rural New England. A less skilled writer might have placed these factors of change in a conclusion; in this front position, however, they serve to inform the reader of the basic features of the plot, so that the meanings and connections are all the more clearly portrayed. It is like reading the last page of a detective story first—which is the way a regional study should be presented.

The author then asks and answers the question "What is New England?" He points out that "the only reason for thinking at all in terms of regions is that the analysis of any problems that are localized is helped if similar or related areas are grouped." He appreciates that regions can be delimited in different ways, but makes the comment that Odum, in his study of the regions of the United States, placed too much emphasis on mere similarity without distinguishing those similarities which

were of social importance. Underlying the similarities, used to define the region, there are great dissimilarities. He feels, however, that if "similarity of interests and social relationships" are used as the criteria, New England ties pretty well together. He is touching, but does not quite state the concept of using relevant similarities, and overlooking the irrelevant differences.

Then follows a series of chapters which are descriptive in character. He discussed the natural endowments, quoting extensively from the studies of William Morris Davis, Charles F. Brooks, Phil Church, and John K. Wright. He describes the distribution of people, the industries, the cities, the trade and transportation, the uses of the land and the history of land use, and the underlying soils. He makes use of an adequate number of maps, in which New England is shown on page size—at a little smaller than 1/500,000,000. He then analyzes the problems of land management, and the factors in the rural economy such as marketing. He devotes one or more chapters to the several major agricultural products. But agriculture is only the first of four major kinds of land use, the others being forestry, recreational, and residential uses. He concludes by discussing trends, prospects, and potentials, and by pointing to the need for a regional policy and program.

A geographer reviewing this book naturally asks concerning it—would a geographer have done it differently? The reviewer was struck as one by the fact that on not one of the many maps in the book was there a scale, not even on maps showing the arrangement of fields in a single farm. Yet many of the maps were borrowed from previous publications. For example, chart 3 is a relief map of New England, borrowed from the *Geographical Review*, Volume 3, 1917, page 228, and reproduced in Volume 7, 1919, page 235. In the *Review* the map has both a representative fraction and a graphic scale, but in Black's book (p. 22) both have been removed. The reproduction is a little smaller than the original, which might have tricked an unwary economist if he had left the representative fraction. Obviously, however, the economist does not subscribe to the idea that a map must have a scale.

But there are much more important matters to point out. Black depends for his basic factual data on the censuses. He makes use of all the censuses since 1920, and in many cases he goes back to the earliest ones. In his use of census data he takes great care to study the categories of things that were

counted, and the conditions of the count. He compares the data from one census with those of another, and shows why certain figures are unreliable. "Half the energy spent in this study," he writes, "has gone into the discovery of the truths in these figures." His analysis of the statistical data is detailed, and the corrections he applies are in some cases, minute. Few geographers would have spent half of their energies on this aspect of the work. Because of his dependence on such data, the contrasts he shows between historical periods or between geographical areas within New England, are made by states, or counties, or groups of counties. The result is that the data, so carefully analyzed and corrected, are then generalized by crude statistical areas so that only the broadest area differences are brought out. To be sure, the maps are precise enough to show the contrasts between southern New England and northern New England, or between counties in southwestern Connecticut, close to New York, and counties in northern Maine, remote from any cities. But the maps are not precise enough to show the differences within, shall we say, Worcester county. The economist would probably say that such precise mapping was not important; the geographer would perhaps say that such meticulous analysis of the statistical data was not important. The ideal would probably be to try to achieve a comparable degree of precision both in statistical and in cartographic analysis.

Greater precision in cartographic analysis would require direct observation in the field. Undoubtedly the author of this work traveled widely in New England, and interviewed many persons in different areas and of different economic status. He has obviously read widely in the published works on his area. But there is no evidence that he made any maps from direct field observation, or that he used field notes in any way to modify the patterns brought out by using census data within crude statistical units. (E.g. examine page 300.) A geographer would probably have combined air photography with his own field observations to delimit more carefully than Black has done, the areas devoted to the various forms of use. The maps of the soils of Vermont and New Hampshire (pp. 196 and 200) are in much greater detail than the maps which show land use for the same areas.

There are only a very few large-scale maps of small areas. There are maps showing farm abandonment in a part of Grafton County, New Hampshire, and in six towns around Windsor, Vermont (the latter bor-

rowed from the *Geographical Review*, with the scale removed). On pages 216 and 217, there are maps of one dairy farm in southern New England, showing the layout of the fields, the use of land in each, and the underlying soil types. The use of fractional codes, and of arrows to show slope directions, suggest that the map was prepared by some one familiar with modern geographical field techniques. Here, also, the absence of a scale is disturbing to a geographer. The map is used to indicate the kind of detailed information needed for work in land management. The accompanying analysis of the kinds of soil maps needed for different uses touches on the problem of scale, and of the relation of scale to objectives.

In his preface, Black asks a very pertinent question—one which might be directed not

only to economists, but also with special force to geographers. He suggests that people outside of New England ask the question whether it is possible to put together a similar kind of synthesis for other parts of the United States, and if so, why has it not been done? It is easy for geographers to point out the details of this work which they would have done with greater precision—but the fact remains that the job was not done. Geographers, or any kind of scholars who are concerned with regional studies, would do well to study the methods of analysis and presentation used in this book on New England which, in spite of its minor blemishes, sets a new standard of performance in this field.

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WATER AND LAND PROBLEMS

Mont H. Saunderson, *Western Land and Water Use*. xi and 217 pp. Norman, Oklahoma: University of Oklahoma Press, 1950.

Bernard Frank and Anthony Netboy, *Water, Land, and People*. xviii and 331 pp. Bibliography. New York: Alfred A. Knopf, 1950.

The student of water and land problems of western United States has been greatly aided by a number of fine volumes treating the subject that appeared in 1950. One of the best of these is Saunderson's *Western Land and Water Use*. There is little in the general discussions that has not been said elsewhere and said better; but wherever the discussion centers on a specific area or on a particular problem (and this makes up most of the volume) the discussions are invaluable. The author has had long experience in dealing with concrete problems of land and water utilization. He is, therefore, fully acquainted with all the details and complexities of the problems which he discusses. Moreover, he has not handicapped himself by adopting any standardized or particular approach to these problems. Because of his long and thorough knowledge of the situations he can deal with any of the important relevant factors with regard to each problem as he discusses it, and he also demonstrates how the various factors vary in importance from area to area with reference to the various problems. This demands some subjective selection and the fact that it is done so successfully illustrates the high degree of mastery which the author has of his subject.

Another valuable aspect of the volume lies in those cases where he has eschewed promulgating a single solution to a problem. Instead, he has analyzed a number of possible solutions, explained what their effects would be, or what additional research is necessary to enable us to determine what those effects would be, and finally has explained the reasons for anticipating the probable effects. Few students of conservation in the United States can study this work carefully without adding much to their knowledge.

It seems clear that the authors of *Water, Land and People* intended to write a book for popular education concerning land and water utilization. It is highly doubtful whether they have succeeded, but in the attempt they have accomplished something equally desirable. The value of the book lies in the variety of land and water management problems and the abundance of detail presented. All major sections of the United States are mentioned in one or another connection.

The volume is divided into three parts: The Problems, The Cost, and The Solutions. Under each of these major headings, however, the authors have not been content merely to present a generalized discussion. They have given specific local illustrations for each of the points and thereby greatly increased the utility of their volume.

The book opens with a short summary of the principles of water and land management, but it would be overly optimistic to suppose that this is a sufficient "education" for an uninformed reader. Despite the very wide

range of topics discussed the book is quite short, and, consequently, the discussions are brief, compact, and concise. In fact, there are little more than allusions to some topics or situations. It seems doubtful whether an uninitiated reader could follow and grasp the implications of more than a few of the many ideas presented. But for a reader with a background of some principles of renewable resource management the concise explanations and wealth of detail enhance the interest of the book.

Apparently the authors realized clearly that because of space limitations (and also probably because of the type of book they were trying to write) their discussions of the various subjects would be inadequate for the serious student of resource management problems. Consequently, they have included a list of references by chapter and a bibliography

arranged under subject headings. The titles have been selected with discrimination and their arrangement by subject should allow a student to extend his investigations along any particular line with celerity by merely following the guideposts furnished by the text, references, and bibliography.

Consequently, it should be of great value for graduate students and undergraduate majors interested in problems of resource utilization, because the detail and widespread coverage are precisely what is needed to enable the student to see how his store of management principles apply in a wide variety of situations, and not artificially simplified situations but ones where a wide variety of interacting factors have been succinctly and disinterestedly described.

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THE SOVIET UNION

Leimbach Werner. *Die Sowjetunion. Natur, Volk und Wirtschaft*. "Kleine Länderkunden, Unser Wissen von der Erde, Herausgegeben von W. Evers." Stuttgart: Franckh'sche Verlagshandlung, 1950. 526 pp. 99 black-and-white maps in text, 116 tables, 2 diagrams, 65 pictures in 40 plates on glossy paper, 1 folded colored map in pocket, bibliography, and index.

Leimbach has succeeded in producing a solidly factual, up-to-date, objective book on the Soviet Union. The book contains much valuable material not elsewhere available, even though in his attempt to be factual the author in places verges on the encyclopedic. No other geography currently available in the Western World contains as much recent material on the Soviet Union, although in his search for the recent the author at times overemphasizes the new to the neglect of the important and occasionally includes material, the pertinence of which is not clear to the reviewer. Between the difficult Scylla and Charybdis of subjective *pro* and *anti* Soviet sources, Leimbach steers a successfully objective course.

The book surveys the Soviet Union as a whole. There is no regional part since the author hopes to write a separate regional volume later. The book treats systematically both physical and human geography. Under physical geography are discussions in turn of (1) location, boundaries, size, and distances, (2) scientific research and research institutes (which should have been an appendix rather

than a part of physical geography), (3) surface configuration, (4) climatic elements, (5) water bodies (particularly detailed), (6) soil, (7) natural zones, and (8) animals. Under human geography are (1) population, (2) administrative divisions, (3) rural and urban settlement, (4) economy (making up 40 per cent of the book), (5) transportation and trade, and (6) foreign trade.

The section on the economy contains a wealth of recent material on agriculture, fishing, forestry, mining, and manufacturing. The discussion of the coalfields may be taken as an example. It is a remarkable bringing together of such information as is available on the current status of each field. One general map and 12 detailed regional maps of individual coalfields provide details rarely found in a general work. Eleven tables provide data on reserves and production. At times the information is less than satisfactory, such as statements that the production in a particular field in a specific year was above or below the planned production but without any clue as to what the planned production was. In other places are statements such as that the production in 1947 increased by a certain percentage over 1946. By itself such a statement is of slight geographic significance, since the reader does not know what the 1946 production was, either in amount or in comparison with a pre-war figure or with a "normal" year (if such exists) or in relation to a general trend. The author doubtless is fully aware of the short-

comings of such figures, which are the best that he could glean from the barrens of Soviet statistics and pronouncements.

Extensive use has been made of both Soviet and Western sources. Much current material has been culled from Soviet radio broadcasts or official newspaper announcements but this material has been screened and geographically organized and interpreted.

The bibliography is carefully selected. The maps, tables, and pictures enrich and supplement the text and add greatly to the value of the book. The colored and colorful folded map in the back pocket is an actual sheet from an atlas.

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YOSEMITE VALLEY

Matthes, Francois E., edited by Fritiof Fryxell, *The Incomparable Valley, A Geological Interpretation of the Yosemite*. xiii and 160 pp.; photographs; diagrams; map; University of California Press, Berkeley and Los Angeles, California, 1950. \$3.75. 6½ × 10 inches.

Yosemite Valley contains some of America's most spectacular scenery. The great height and beauty of the waterfalls, and the distinctiveness of the glacially sculptured landscape indeed justify the name "The Incomparable Valley." This book is dedicated to "all who love the mountains, particularly those who come to see, and seeing, wonder and wish to understand." It is not intended to be an exhaustive treatise, or one which presents much that is new.

Dr. Francois Matthes was an outstanding authority on Yosemite and the Sierra Nevada. His *Geologic History of the Yosemite Valley* (Professional Paper 160, U. S. Geological Survey) is the most comprehensive work ever attempted on Yosemite. After Matthes' death in 1948 his unpublished writings and notes, including the plan for *The Incomparable Valley*, were submitted to the University of California Press. The Press called in Fritiof Fryxell, a geologist and an intimate friend of Matthes, to edit the book.

The first chapter provides the regional setting for Yosemite through a discussion of the Sierra Nevada. Emphasis is directed toward the role of glaciation and faulting in the development of the present terrain, and frequent references are made as to the exact places where evidence of the geologic past can be found. The reader who is not familiar with the Sierra Nevada region may become lost in the details of place geography in this chapter. A good map showing location of places mentioned certainly would have been a worth while addition.

Succeeding sections of the book describe Yosemite Valley in considerable detail, and trace its gradual evolution from a broad, shallow valley to its present deep, steep-sided form. Three separate ice advances sculptured

the valley walls, and set the stage for the development of the spectacular waterfalls. Considerable attention is given to the relationship between the joint systems of the rocks and the physical form of the valley. Evidence is also presented which indicates that the approximately sixty small living Sierran glaciers are not relics from the Ice Age, but are of a new generation born only about four thousand years ago.

One chapter deals wholly with the waterfalls. These falls attain their greatest splendor in early summer when melting snows contribute the maximum of water. The waterfalls may be divided into two categories: those that fall over steps in the valley floor such as Vernal Fall and Nevada Fall, and those that fall into the main valley from hanging side valleys. Examples of the second type are Yosemite Fall and Bridalveil Fall. This chapter is concluded by a brief survey of the world's highest waterfalls which is particularly effective in demonstrating the high ranking position of the Yosemite Valley falls. So far as could be ascertained at the time of writing, Upper Yosemite Fall with a drop of 1430 feet, was the highest free-leaping waterfall in existence.

One of the book's most attractive features is the large number of excellent photographs it contains. Many of the photographs were taken by Ansel Adams, whose camera studies are some of the finest ever made of this highly photogenic area. There also is a series of six paintings made under the supervision of Matthes, illustrating the successive stages of the geological development of the valley. It seems unfortunate to this reviewer that these photographs and drawings were grouped together at the front of the book rather than distributed at pertinent places within the text.

The book contains a wealth of scientific knowledge written in a language that the ordinary tourist can comprehend, and at the same time in a form that a geologist will find enjoyable.

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